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Introduction

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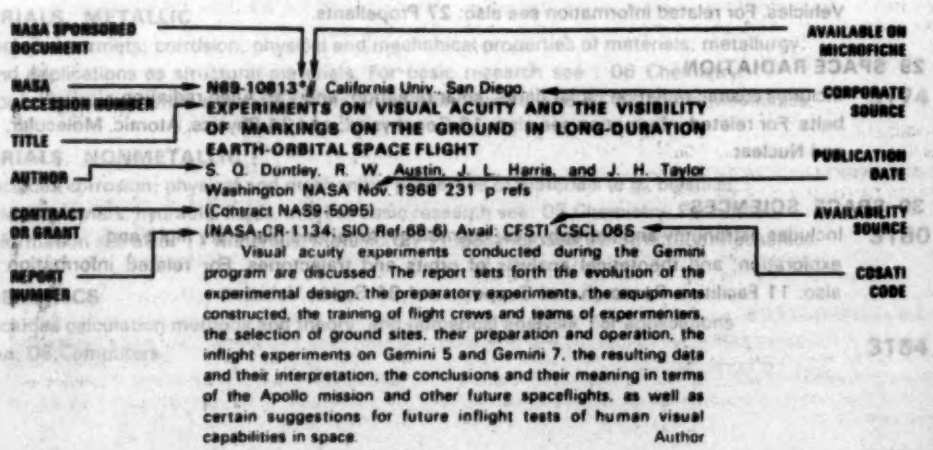
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EXPERIMENTS ON VISUAL ACUITY AND THE VISIBILITY OF MARKINGS ON THE GROUND IN LONG-DURATION EARTH-ORBITAL SPACE FLIGHT
AUTHOR
S. Q. Duntley, R. W. Austin, J. L. Harris, and J. H. Taylor
PUBLICATION DATE
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Visual acuity experiments conducted during the Gemini program are discussed. The report sets forth the evolution of the experimental design, the preparatory experiments, the equipments constructed, the training of flight crews and teams of experimenters, the selection of ground sites, their preparation and operation, the inflight experiments on Gemini 5 and Gemini 7, the resulting data and their interpretation, the conclusions and their meaning in terms of the Apollo mission and other future spaceflights, as well as certain suggestions for future inflight tests of human visual capabilities in space.
Author

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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N69-30809*# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.

SUBSONIC SPHERE DRAG MEASUREMENTS AT INTERMEDIATE REYNOLDS NUMBERS

Kenneth R. Sivier and J. A. Nicholls Washington NASA Jul. 1969 79 p refs

(Grant NGR-23-005-003)

(NASA-CR-1392) Avail: CFSTI CSCL 01A

The drag of spheres, at subsonic Mach numbers and Reynolds numbers from 25 to 4000, was studied in a continuous wind tunnel using a one-component, magnetic support-and-balance system. The low turbulence incompressible results verified this experimental approach, especially at Reynolds numbers below 300 where the spherical models were not disturbed by unsteady lateral forces. Measurements were also made to evaluate the effects of compressibility, slip flow (Knudsen numbers up to 0.04), sphere surface roughness, and free-stream turbulence (intensities up to 8%). Author

N69-30832*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

TWO-DIMENSIONAL CASCADE INVESTIGATION OF A TURBINE TANDEM BLADE DESIGN

Stanley M. Nosek and John F. Kline Washington Jul. 1969 18 p refs

(NASA-TM-X-1836) Avail: CFSTI CSCL 01B

Static pressures were measured on the surfaces, and total pressures were surveyed downstream of the trailing edge. The objective was to determine the surface flow characteristics and the trailing edge wake characteristics. Also overall performance in terms of kinetic energy loss was determined. Tests were with a six-bladed (five-passage) cascade in a tunnel open to atmosphere at the inlet. The inlet-total to exit-static-pressure ratios were over a range from 1.2 to 1.5. Author

N69-30722*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

INVESTIGATION OF A 0.3-SCALE JET-TRANSPORT MODEL HAVING A JET-AUGMENTED BOUNDARY-LAYER-CONTROL FLAP WITH DIRECT-LIFT CONTROL CAPABILITY

Kiyoshi Aoyagi, Stanley O. Dickinson, and Paul T. Soderman (Army Aeron. Res. Lab.) Washington Jul. 1969 86 p refs

(NASA-TN-D-5129) Avail: CFSTI CSCL 01B

An investigation was conducted to define a trailing edge flap system for a large scale subsonic jet transport model that would provide high lift at low-thrust-to-weight ratios (0.05 to 0.10) and direct lift control. The model has a 35° swept wing of aspect ratio 6.43 and four pod-mounted engines under the wing. The flap system was externally jet-augmented from the exhaust of the inboard jet engines. The flap system consisted of a main flap with blowing boundary layer control and a small auxiliary flap for providing direct lift control. Results were obtained with three boundary layer control arrangements and two different auxiliary flap chords at several main and auxiliary flap deflections. Three-component longitudinal data and descent capabilities of the model with the resultant flap system are presented. The results of descent performance computations indicate that the resultant flap system is capable of providing ±0.2 g incremental acceleration normal to the flight path at an approach speed of 117 knots (1 g flight wing loading = 53 psf) or a 4° change in flight-path angle with a thrust-to-weight ratio of 0.05. Author

N69-30869*# Pratt and Whitney Aircraft, East Hartford, Conn.

SINGLE-STAGE EVALUATION OF HIGHLY-LOADED HIGH-MACH-NUMBER COMPRESSOR STAGES

M. T. Monsarrat, M. J. Keenan, and P. C. Tramm 18 Jul. 1969 118 p refs

(Contract NAS3-10482)

(NASA-CR-72562; PWA-3548) Avail: CFSTI CSCL 01C

A compressor stage of 1600 ft/sec (487.7 m/sec) tip speed, a D factor at 10 percent span from the tip of 0.5, and a hub/tip ratio of 0.5 was designed to deliver a pressure ratio of 1.936 with an efficiency of 0.842. The design flow rate is 197.1 lb/sec (84.889 kg/sec). Three rotors were designed, the first with multiple-circular-arc airfoils, the second with slotted airfoils, and the third with tandem airfoil sections. The same stator was used with all three rotors. The aerodynamic design was based on typical performance requirements for advanced fans. Mechanical design included structural and vibration analyses. Centrifugal stress, gas bending stress, and stress produced by untwist are all well within the capabilities of the AMS 4928 titanium alloy to be used for the blades. Author

N69-30878*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A STUDY OF HELIUM PENETRATION AND SPREADING IN A MACH 2 AIRSTREAM USING A DELTA WING INJECTOR

Louis A. Povinelli, Frederick P. Povinelli, and Martin Hersch Washington Jul. 1969 17 p refs

(NASA-TN-D-5322) Avail: CFSTI CSCL 01B

Experiments were conducted to determine if vortices could aid the penetration and spreading of helium in a Mach 2 airstream. A half-delta-wing injector, having a 30° semiapex angle and a 12° angle of attack, was used. This delta configuration was designed to produce leading edge vortices into which helium was injected. A flat plate of the same blockage area and at the same angle of attack was also run for comparison. Measured helium concentration showed that the half-delta injector was more effective than the angled flat plate in achieving greater penetration along the vortex position. The spreading was also larger with the delta injector. Author

N69-31118# Weapons Research Establishment, Salisbury (Australia).

WIND TUNNEL TESTS ON AN AXISYMMETRIC, LIFTING BOMBLET WITH BODY MOUNTED, RECTANGULAR FINS

C. A. J. Fletcher Dec. 1968 32 p refs

(WRE-TN-HSA-141) Avail: CFSTI

Comprehensive wind tunnel tests were conducted to ascertain the static and dynamic characteristics of an axisymmetric, lifting bomblet. The bomblet was designed to have a highly nonlinear pitching moment variation with incidence, causing it to trim in the 10° to 15° incidence range depending on the center of gravity position. The bomblet characteristics are nearly insensitive to Mach number in the range 0.35 to 0.80, and to Reynolds number in the range 2.1×10^5 to 4.4×10^5. Above M = 0.80 and below Re = 2×10^5 the static characteristics, particularly the pitching moment variation with incidence, show a definite change. Changing the nose shape produced a significant change in the Magnus characteristics and a small change in the roll damping characteristics, but a negligible effect, discounting the use of nose strakes, on the static characteristics. Author

N69-31206# MITHRAS, Inc., Cambridge, Mass.

PHOTOMETRIC MEASUREMENTS OF TURBULENCE IN A HYPERSONIC WAKE Final Letter Report, 1 Oct. 1966–30 Sep. 1968

Jacques A. F. Hill and Emanuel Wachsler Feb. 1969 38 p refs

(Contract AF 49(638)-1494)

(AD-685135; AFOSR-69-0851TR) Avail: CFSTI CSCL 20/4

Turbulent density fluctuations in the near wake (x/d 10) of a slender body were measured in a wind tunnel at m = 8. Autocorrelations were obtained at several stations as well as cross-correlations for various streamwise separations of the two measurement stations. In addition, power spectra and relative intensities of the fluctuations were measured. Author (TAB)

N69-31228*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SHOCK SHAPES AND PRESSURE DISTRIBUTIONS FOR LARGE ANGLE POINTED CONES IN HELIUM AT MACH NUMBERS OF 8 AND 20

David A. Stewart and Mamoru Inouye Washington Jul. 1969 22 p refs

(NASA-TN-D-5343) Avail: CFSTI CSCL 01A

Bow-wave shapes and surface pressures were measured in helium at Mach numbers 8 and 20 on pointed cones with semivertex angles from 52° to 90°. For large cone angles ($\geq 65°$) the bow wave was nearly spherical, the bow-wave shape and surface pressure distribution were predicted adequately by both the method of integral relations and the method of Ksattari, and the bow-wave shape was not influenced by cone angle or a small amount of bluntness. For cone angles approaching shock attachment (attachment$< \sigma <$ 65°) where the bow wave was no longer spherical, the method of integral relations adequately predicted the shock shape and surface pressure distribution. The Ksattari method was not applicable for these conditions. Author

N69-31337*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A FINITE-STEP METHOD FOR CALCULATION OF THEORETICAL LOAD DISTRIBUTIONS FOR ARBITRARY LIFTING SURFACE ARRANGEMENTS AT SUBSONIC SPEEDS

James A. Blackwell, Jr. Washington Jul. 1969 42 p refs

(NASA-TN-D-5335) Avail: CFSTI CSCL 01A

A simple theoretical method has been developed to compute the load distribution in subsonic compressible flow of arbitrary wings and lifting-surface arrangements. A finite-step method was used in the analysis. The results of the theoretical method have been compared with experiment and show good agreement. Author

N69-31360*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANALYTICAL INVESTIGATION OF TWO-DIMENSIONAL LOSS CHARACTERISTICS OF SUPERSONIC TURBINE STATOR BLADES

Louis J. Goldman and Michael R. Vanco Washington Jul. 1969 22 p refs

(NASA-TM-X-1823) Avail: CFSTI CSCL 01A

An analysis was conducted to determine the loss characteristics of two-dimensional, minimum length, supersonic nozzles with sharp-edged throats. Boundary layer characteristics were calculated and used to obtain the conditions downstream of the nozzles after the flow had mixed to a uniform state. Subsonic, sonic, and supersonic aftermixing axial Mach number solutions were obtained for this model. The loss characteristics were investigated for nozzles designed over an exit Mach number range of 1.5 to 5.0. The effect of nozzle flow angle, throat Reynolds number, and specific heat ratio on losses were studied. Author

N69-31369# ARO, Inc., Arnold Air Force Station, Tenn.

FREE-FLIGHT INVESTIGATION OF THE AERODYNAMIC CHARACTERISTICS OF A 10 DEG SEMIANGLE CONE AT MACH NUMBERS FROM 8 TO 16 Final Report, May 1967–Jun. 1968

C. J. Welsh, G. L. Winchenbach, and A. N. Madagan AEDC Apr. 1969 51 p refs

(Contract F40600-69-C-0001)

(AD-686407; AEDC-TR-69-63) Avail: CFSTI CSCL 20/4

A 1000-ft hypervelocity range was used to obtain the free-flight static and dynamic stability and drag data presented for a 10-deg semiangle cone. Measurements indicate that the damping-in-pitch derivatives for the cone increase appreciably with increasing Mach number between M = 8 and 16 at a Reynolds number (based on model length and free-stream conditions) of about 400,000. Further, the pitching-moment derivative for the cone decreases significantly as the nose-radius to base-radius ratio of the cone is increased up to 0.1 for amplitudes greater than about 5 deg. Comparisons of the range stability data with wind tunnel data (involving sting-supported models) obtained in different test facilities indicate that appreciable differences in the pitching-moment derivative and the damping-in-pitch derivatives exist in some cases. Author (TAB)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N69-30633*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

STATIC STABILITY CHARACTERISTICS OF A 0.16-SCALE MODEL OF A JET-LIFT, V/STOL RESEARCH AIRPLANE IN CRUISE

Matthew M. Winston Washington Jul. 1969 23 p refs

(NASA-TM-X-1835) Avail: CFSTI CSCL 01C

The investigation was conducted in the 17-foot test section of the 300 mph 7-by-10-foot tunnel. The longitudinal characteristics of the basic configuration indicate a need for improved stability in cruise. The effects of adding auxiliary horizontal-tail surfaces are shown. Also, the characteristics of the model with an alternate horizontal-tail arrangement are discussed. The effects of these modifications on the basic lateral directional characteristics of the model and the effects of cruise power on all configurations are included. Author

N69-30727*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AN EXPERIMENTAL INVESTIGATION OF THE MIXING OF COMPRESSIBLE-AIR JETS IN A COAXIAL CONFIGURATION

James M. Eggers and Marvin G. Torrence Washington Jul. 1969 52 p refs

(NASA-TN-D-5315) Avail: CFSTI CSCL 01B

An experimental investigation was made to obtain data on the mixing of parallel, circular, compressible-air jets in a coaxial configuration. A Mach 1.3 outer jet and a near-sonic central jet, both exhausting to a quiescent atmosphere were studied. Data were also obtained with both jets operating at subsonic Mach numbers. Radial distributions of total pressure, static pressure, and mass fraction concentration (air in air)of the central jet gas were determined at downstream axial stations both in the near-jet jet and far-jet flow fields. Concentration measurements were made by using a tracer-gas technique. The central-jet gas was a 1% mixture of ethylene in air. At each test condition, the total temperature of both jets was approximately 300° K. The Reynolds numbers for the supersonic and subsonic outer-jet flow were approximately 42.1×10^6 and 13.9×10^6 per meter, respectively. Results of the investigation indicate that good correlation with the experimental air mixing data can be obtained by using an eddy viscosity model based on a representative width of the mixing zone and on the center-line mass flow per unit area. The concentration decay in the region wall downstream of the concentration potential core was found to be inversely proportional to the square of the axial coordinate. The accuracy of the concentration measurements was found to be significantly affected by sampling technique and sampling probe design. Author

N69-30964# RAND Corp., Santa Monica, Calif.

RELIABILITY OF AIRCRAFT AS DETERMINED BY OPERATIONAL FIELD TESTS: THE NEED FOR PROPER TEST DESIGN AND DATA REQUIREMENTS

Chauncey F. Bell Apr. 1969 17 p Presented at NATO Conf. on the Appl. of Operational Res. to Reliability, Turin, 30 Jun.-4 Jul. 1969

(AD-686414; P-4054) Avail: CFSTI CSCL 1/3

The paper is concerned with complete aircraft systems, such as tactical fighter squadrons and intratheatre (or airline) transportation systems. Industry on the one hand, and operators (airlines, military services) on the other, are faced with the problem of agreeing to specifications concerning reliability and maintainability, validating these specifications in the finished product and deciding what value to attach to reliability and maintainability. The problem of validation is particularly elusive. Laboratory or subsystem tests provide one set of figures. Different airlines using the same equipment experience different reliabilities. The same military aircraft type behaves differently at different bases, or when flying different mission types. Apparently satisfactory planning factors for procurement of spare parts, or maintenance manpower, turn out to be at wide variance with the requirements generated in operational environments. Author (TAB)

N69-30984*# Honeywell, Inc., Minneapolis, Minn. Aerospace and Defense Group.

COMPUTER RECOMMENDATIONS FOR AN AUTOMATIC APPROACH AND LANDING SYSTEM FOR V/STOL AIRCRAFT. VOLUME 1: COMPUTER RECOMMENDATIONS

Harry T. Gaines, Adel K. Hilal, Robert J. Kell, Howard A. Knudtson, Tom E. Leonard et al Jun. 1968 61 p refs

(Contract NAS12-615)

(NASA-CR-86173; Honeywell-20987-TR2-Vol-1) Avail: CFSTI CSCL 01C

Recommendation for a digital computer complex was derived from the Advanced V/STOL Avionics Technology Program. This complex will be a core item for the planned V/STOL automatic approach and landing concept flight evaluation. A central digital computer will be required to perform most of the navigation, guidance, control, and display computations. The approach taken in arriving at a computer recommendation has emphasized the program's immediate objectives. Minimum requirements were established through definition of a baseline automatic approach and landing system. The need for configuration changes during the useful life of the computer complex was recognized through evaluation of computer flexibility and growth capabilities of each candidate computer. Results of the computer recommendation are presented as well as the rationale of the selection. D. L. G.

N69-30985*# Honeywell, Inc., Minneapolis, Minn. Aerospace and Defense Group.

COMPUTER RECOMMENDATIONS FOR AN AUTOMATIC APPROACH AND LANDING SYSTEM FOR V/STOL AIRCRAFT. VOLUME 2: EQUATIONS

Harry T. Gaines, Robert J. Kell, Avery A. Morgan, Leo J. Mueller, James R. Peterson et al Jun. 1968 166 p refs

(Contract NAS12-615)

(NASA-CR-86174; Honeywell-20987-TR-2-Vol-2) Avail: CFSTI CSCL 01C

A preliminary automatic approach and landing system definition has been completed. It is considered to be a configuration typical of that which would be suitable for V/STOL use. It is designed specifically for the designated flight test vehicle, the 1A helicopter, and is intended to have sufficient flexibility to evaluate a variety of technology concepts. Design details and requirements are discussed. Included are functional and mode requirements for navigation, guidance, control, and displays, and an evaluation of analog attitude rate gyros for an alternate analog inner-loop stabilization mechanization. Results given are in terms of applicable equation and computation requirements for each subsystem. Navigation computations are based on the use of a strap-down inertial reference unit. Guidance requirements are established and

guidance laws are defined for the generalized V/STOL approach situation. Numerical values selected for each of the various parameters are based on the designated flight test vehicle. Guidance equations include the derivation of velocity commands. The baseline guidance subsystem is discussed relative to optimum path control.
Author

N69-31040# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Deputy for Engineering.
COMPUTER PROGRAM FOR REDUCING STATIC PROPELLER TEST DATA
Gerald T. Cafarelli and Matthew H. Chopin Jun. 1968 38 p
(AD-675643; ASD-TR-68-19) Avail: CFSTI CSCL 1/3

A computer program using a curve-fit technique was developed to reduce performance data obtained from static tests of aircraft propellers. The entire program is written in FORTRAN IV language for use on the IBM 7094 computer. The program accepts static whirl rig test data (ie, raw rpm, horsepower, and thrust data) obtained at a fixed blade angle and reduces it into pertinent propeller relationships. The program first reduces the test data into various coefficients and computes the propeller tip Mach number. A curve fit technique then fits running curves through the test thrust and horsepower data points at the test tip Mach numbers. Intermediate horsepower and thrust values are determined from the fitted curves at selected Mach number increments, and all coefficients are recomputed. This results in a presentation of the reduced data in two forms, coefficients computed from the actual test data and coefficients obtained at specific constant Mach number increments from the fitted curves. The data are presented in tabular printout form. This is a general program and is written so that the order of the curve fit, the Mach number increment, the number of test data points and the Mach number range can be varied. The entire program deck and all nonstandard subroutines are included.
TAB

N69-31080# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
A METHOD FOR DETERMINATION OF OPTIMUM VEHICLE SIZE AND FREQUENCY OF SERVICE FOR A HAUL V/STOL AIR TRANSPORT SYSTEM
R. W. Simpson and M. J. Neuve Eglise May 1968 43 p refs
Presented at the 1968 ORSA/TIMS Natl. Meeting, San Francisco, May 1968
(Contract C-136-66)
(R-68-1) Avail: Issuing Activity

To compete successfully in short haul markets under 200 miles, an air transport system must offer a high daily frequency of service, N, as well as short air travel times. In a given market, N can be increased by using vehicles of smaller seat capacity, C, which are more expensive per seat to operate. A method of determining optimal values of N and C for assumed market behavior in terms of fare and time elasticities is presented. By defining total trip time to include the average wait for service, and using a demand model developed for the Northeast Corridor, the air share of total demand in any market can be calculated as a function of N and the competing fares. Plotting daily passengers versus N, and relating this to the maximum and breakeven load factors for a family of vehicles of different seating capacities, determines the values of N and C which maximize return to the operator.
Author

N69-31117 Board of Trade, London (England).
CIVIL AIRCRAFT ACCIDENT: REPORT ON THE ACCIDENT TO SLINGSBY T21b GLIDER BGA NO. 700 AT WESTON-ON-THE-GREEN AERODROME, OXFORDSHIRE ON 9 APRIL 1967.
1968 9 p
(CAP-289; EW/C/0164) Avail: HMSO 2s 6d

During an approach to land in turbulent wind conditions the glider pitched suddenly into a dive from about 150 feet and struck the ground almost vertically. The investigation revealed no evidence of defect in the glider; both pilots were in good health. The accident is attributed to the glider becoming fully stalled at a height from which recovery from the ensuing dive was unlikely.
Author

N69-31195# National Transportation Safety Board, Washington, D.C.
A PRELIMINARY ANALYSIS OF AIRCRAFT ACCIDENT DATA, US CIVIL AVIATION, 1968
Jan. 1969 31 p
(PB-182866) Avail: CFSTI CSCL 01B

The analytical portion of the report presents data on accidents, fatalities, rates, and growth changes as percentage changes of the 1968 data compared with a base figure. The base figure was established by averaging the data for the five year period 1963-1967. Such a presentation helps to eliminate annual variations inherent in accident report data and allows more meaningful comparisons than would the customary year-by-year comparisons. This base figure can also be used as a standard and can be compared with other periods.
Author (USGRDR)

N69-31230 Board of Trade, London (England).
CIVIL AIRCRAFT ACCIDENT: REPORT ON THE ACCIDENT TO BOCIAN GLIDER: BRITISH GLIDING ASSOCIATION NO. 1386, AT ROYAL AIR FORCE STATION, BICESTER, OXON, ON 4 JULY 1967
R. C. Warren 1968 10 p
(CAP-298; EW/C/0175) Avail: HMSO 2s 6d

During a turn at low airspeed after releasing from a winch launch at a height lower than normal, the glider entered a spin from which no signs of recovery were observed before the glider struck the ground. The investigation has revealed no evidence of structural failure or defect which would account for the inability to recover from the spin.
Author

N69-31295*# National Academy of Engineering, Washington, D.C. Aeronautics and Space Engineering Board.
ECONOMICS OF CIVIL AVIATION
Dec. 1968 47 p refs
(Contract NSR-09-012-912)
(NASA-CR-103241) Avail: CFSTI CSCL 01B

A general discussion resulting from committee reports on the economics of civil aviation in modern society is presented. The sheer bulk of commercial passenger aviation, commercial cargo aviation, general aviation, and V/STOL aircraft was considered inhibiting to healthy growth and economic stability in the role of civil aviation in the national industrial scene. A modern multiple cost-benefit analysis with modeling of subelements such as airports and aircraft noise was recommended to the governmental agencies which supervise economic studies. As a consequence, priorities among the critical factors could be identified as well as areas which could be assisted from current financial or technological resources.
M. H. E.

N69-31347*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
THE EFFECT OF CONSTRAINTS ON OPTIMUM APPROACH AND DEPARTURE PATHS FOR VTOL TERMINAL OPERATIONS
Walter M. Hollister and John R. Leet Feb. 1969 48 p refs
(Contract NAS12-2081; Grant NGR-22-009-229)
(NASA-CR-103293; RE-55) Avail: CFSTI CSCL 01C

A VTOL aircraft is modeled as a point mass moving in a vertical plane acted upon by thrust, gravity, lift, and drag. Approach and departure paths are studied under various constraints using a hybrid computer simulation. The pilot has control over angle of attack, thrust magnitude, and thrust direction. Fuel consumption is taken to be proportional to the time integral of the thrust. Constraints are placed on the approach path plus the maximum value of velocity, acceleration, and angle of attack. The most significant consideration for fuel economy is minimization of the time during which the aircraft flies below conventional stall speed. In general, the steeper the approach or departure path, the greater the fuel cost. Fuel-optimum approaches call for high descent rates at low altitude. When the rate of descent is constrained, the fuel cost increases but loses its sensitivity to approach angle. Automatic velocity control is necessary to maintain the glide path during steep approaches. Author

N69-31353*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.

EVALUATION OF TERMINAL CONSTRAINT ON ERROR STATE VECTOR FOR VTOL LANDING GUIDANCE

Anil N. Joglekar May 1969 14 p refs

(Grant NGR-22-009-229)

(NASA-CR-103269; RE-57) Avail: CFSTI CSCL 01C

The analysis shows that for all weather reliability of operation of 99.5% and for the assumed configuration of the terminal, the allowable error in the position of VTOL aircraft at 350 feet from the terminal is less than 50 feet in range, 25 feet across range and 10 feet in height. The ceiling decides allowable vertical error while visibility and terminal configuration determine allowable range and cross range errors. For the maximum allowable errors, the breakout point should be as far away from the landing pad as the visibility and ceiling will permit. To take advantage of increased visibility and ceiling, a glide slope of about 15°–18° might be preferable between 350 feet and 1,400 feet from the pad. The use of IMU eliminates the limitations on the glide slope and significantly improves the controllability of the aircraft. With an integrated sensor package consisting of an IMU and SAILS, it is feasible to achieve the desired accuracy along the range and across the range. Author

N69-31603 World Meteorological Organization, Geneva (Switzerland).

PRESENT STATE OF KNOWLEDGE REGARDING PERFORMANCE CHARACTERISTICS AND THE OPERATION OF SST AIRCRAFT

In its Aeron. Meteorology 1969 p 317–323 (See N69-31576 17-20)

Avail: Issuing Activity

Operational characteristics of Anglo–French and U.S. SST aircraft are described. The planning action taken by the International Civil Aviation Organization (ICAO) regarding air navigation, flight routes, and meteorological requirements for future SST commercial operations is reviewed, as well as areas which must be explored in the future to insure optimum economic conditions and flight safety. Cooperation between the ICAO and other international organizations, such as the World Meteorological Organization and conferences held during the preliminary planning phases in SST development are also summarized. A.C.R.

N69-31604 World Meteorological Organization, Geneva (Switzerland).

PERFORMANCE AND OPERATING CHARACTERISTICS OF SST AIRCRAFT [CARACTERISTIQUES DE PERFORMANCES ET D'EXPLOITATION DES AVIONS DE TRANSPORT SUPERSONIQUES]

G. Leblanc *In its* Aeron. Meteorology 1969 p 324–332 In FRENCH (See N69-31576 17-20)

Avail: Issuing Activity

Performance and operating characteristics of the Concorde are presented from projected real flight data. Aerodynamic profiles of the Concorde demonstrated the structural heat shield at maximum velocity and the limitation of capability in the event of piloting errors or atmospheric disturbances. The profiles of temperature effects on acceleration efficiency and structural soundness showed that these effects created highest risks in the acceleration phase of flight. Head winds in the Paris–New York direction and their effect on fuel consumption of the Concorde were charted in relation to supersonic cruising speed and efficiency. A comparison of general characteristics of the Concorde, the Tupolev, and the Boeing 2707 was used to clarify differences in capability, although all three are in flight at Mach 2. The horizontal tail unit and variable wing units of the Boeing 2707 were described as the most adaptable type in flight. Transl. by M.H.E.

N69-31741# Dynamic Science, Phoenix, Ariz. Avser Facility.

A STUDY OF FORCES CAUSED BY HEAD IMPACT ON AIRCREW PERSONNEL ARMOR UNDER SIMULATED CRASH CONDITIONS

Clifford I. Gatlin, James L. Schamadan, Edward R. Barron (Army Natick, Labs.), and Stanley D. Tanenholtz (Army Natick, Labs.) Nov. 1968 108 p refs *Its* C&PLSEL-59

(Contract DAAG17-67-C-0138)

(AD-685838; TR-69-49-CE) Avail: CFSTI CSCL 1/2

The results of a test program conducted to determine the magnitude, duration and shape of the force-time relationship resulting from head impact on personnel armor in a crash situation are presented. The program was divided into two major tasks. The first included modification of an armor front torso plate to carry the test instrumentation, modification of the anthropomorphic dummy to improve human simulation, and modification of the UH-1B/D armored crew seat to prevent failure. The second task involved the performance of 12 dynamic tests using two different types of aircrew personnel armor, both with and without a protective helmet. The test results indicated that significant head/armor impact occurs most frequently in the chin area. Such contact-produced impact pulses that were triangular in shape with peak loads ranging from 27 to 500 pounds and time duration ranging from 0.025 to 0.045 seconds. Loads on the chin of this magnitude and duration would not be expected to produce serious injury to a human being. Author (TAB)

N69-31777# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Dynamics Lab.

DIRECT LIFT CONTROL FOR APPROACH AND LANDING

Robert C. Lorenzetti 1969 34 p refs

(AD-686081) Avail: CFSTI CSCL 1/3

Direct lift control (DLC) is a system which produces lift forces in the direction the pilot desires to move the airplane without significant pitching moment. DLC enhances precision longitudinal maneuvering capability by providing a change in altitude or rate of climb without a change in pitch attitude and without the initial acceleration reversal, delay in lift build-up, and excessive pitch rate overshoot associated with conventional elevator control. Operation of DLC in approach and landing is discussed. Author (TAB)

N69-31783*# Systems Technology, Inc., Hawthorne, Calif.

AIRCRAFT STABILITY AND CONTROL DATA

Gary L. Teper Apr. 1969 134 p

(Contract NAS2-4478)

(NASA-CR-96008; STI-TR-176-1) Avail: CFSTI CSCL 01A

Data of interest to handling qualities investigators are presented for various current aircraft. Included are those required to obtain transfer functions for the aircraft's response to control inputs. Where possible, an analytical description of the aircraft's stability augmentor is given, and also the complete flight envelope of each aircraft is covered for its most common configuration and loading. Computed transfer functions for various flight conditions are included. Author

N69-31787# Federal Aviation Administration, Atlantic City, N.J. National Aviation Facilities Experimental Center.
AN INVESTIGATION OF IN-FLIGHT FIRE PROTECTION WITH A TURBOFAN POWERPLANT INSTALLATION Final Report
Eugene P. Klueg and James E. Demaree Apr. 1969 241 p refs
(AD-686045; FAA-NA-69-26) Avail: CFSTI CSCL 1/2

The potential explosive and fire hazards and methods of detecting and controlling in-flight fires on modern aircraft powerplant installations were investigated under full-scale simulated low altitudes flight conditions. Modifications were made to the pod-mounted turbofan engine test article to extend the program scope beyond the normal range of variables present on the installation. The test program consisted of five studies: (1) environmental conditions producing thermal egnition of combustible mixtures and ignition characteristics, (2) characteristics of nacelle fires, (3) system performance and installation requirements for fire and overheat detection, (4) requirements for extinguishing and controlling fires, and (5) effects of fires and explosions on the powerplant installation. The results of the program are presented as fire safety design criteria and engineering data. Author (TAB)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N69-30471*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NICKEL-CADMIUM BATTERY TEST PROJECT: RELATIONSHIP BETWEEN OPERATION, LIFE AND FAILURE MECHANISM. VOLUME 2: BATTERY TEST RESULTS
G. Halpert and J. M. Sherfey Mar. 1969 299 p refs
(NASA-TM-X-63587; X-735-69-24) Avail: CFSTI CSCL 10C

This program was designed to establish optimum methods for operating nickel- cadmium batteries in order to substantially increase their cycling life. Fifteen batteries containing aerospace-type cells were operated under related, but different, cycling schemes to determine the effects of rapid charging, rapid discharging, charge termination, and other factors on the life of a nickel-cadmium battery. The computerized test automatically monitored and recorded the many parameters that characterize the operation of a cell. These included capacity, watt-hours, current efficiency, energy efficiency, voltage, and pressure. The parameters were analyzed as a function of cycle life. The results have led to a set of seven relationships between operation and cycle life. It is suggested that these be considered when designing a battery system for long life. Author

N69-30887# Army Electronics Command, Fort Monmouth, N.J.
CHARACTERISTICS OF m-DINITROBENZENE (h-DNB) DRY CELLS
James Bruce Doe Jan. 1969 36 p refs
(AD-684916; ECOM-3089) Avail: CFSTI CSCL 10/3

The performance of the Mg/Mg(ClO4)2/m-DNB system is evaluated for various temperatures, hourly rates, and shelf-life periods. Extensive data is given for three cell sizes: R(N), A and D. Techniques for fabrication of the above cells, which are adaptable for high-speed assembly, are mentioned. Finally, a comparison of the Mg/Mg(ClO4)2/m-DNB system with the Mg/Mg(ClO4)2/MnO2 is given with respect to energy densities and performance curves. Improvements in cathode efficiency, corrosion inhibition, and a mechanical seal will have to be initiated in the Mg/m-DNB system before it will be able to compete with the present Mg/MnO2 system. Author (TAB)

N69-30919*# Fairchild Hiller Corp., Farmingdale, N.Y. Republic Aviation Div.
DEVELOPMENT OF A MICROINCH ACTUATOR
Richard Rupp 28 Apr. 1969 45 p
(Contract NASL-7018)
(NASA-CR-66795; PC072R0002; PCD-TR-69-4; FHR-3352-2) Avail: CFSTI CSCL 10B

Three microinch actuators were developed, manufactured, and tested. These devices were designed to have the capability to make linear displacements adjustable from 5×10^{-7} inch to 20×10^{-6} inch per step, move at a rate of 3×10^{-4} inch per second, and work against an opposing force of 5000 grams. In addition, the actuator was to have the capability to vary the step size and/or step rate of its movement. The cross-sectional area of the actuator is such that it can be mounted on a three-inch center. A piezoelectric "inching" unit with successive clutches is used in the device. The piezoelectric action results in small linear displacements, adequate force levels, and moderate frequency response. Problems in connection with the small displacements, which require tolerance criteria and machining techniques close to the state-of-the-art limits, are discussed in detail. Major operating problems were sporadic failures, temperature dependence, spurious movements, and the inability to support a load. Solutions to these problems are indicated. K.W.

N69-30920 Kernforschungsanlage Juelich (West Germany). Institut Fuer Technische Physik.
APPLIED MAGNETOHYDRODYNAMICS. VOLUME 4: MEASURING RESULTS AND OPERATIONAL EXPERIENCES WITH THE MHD EXPERIMENTAL FACILITY ARGAS I [ANGEWANDTE MAGNETOHYDRODYNAMIK. HEFT 4: MESSERGEBNISSE UND BETRIEBSERFAHWUNGEN MIT DER MHD-VERSUCHANLAGE ARGAS I]
T. Bohn, K. Grawarsch, Ch. Holzapfel, G. Kolb, P. Komarek et al Mar. 1969 63 p refs In GERMAN
(Jul-58-TP) Avail: CFSTI

This operation was intended as a model study for large MHD power plant projects. The characteristics of the structural components were measured in cold and hot operations and with cesium injection and separation. Design values were verified during these operations. The design specifications were met except for the cesium recovery operation. The properties of all materials, including tantalum, molybdenum, Incoloy 800, and aluminum oxide used in channel insulation, were found to meet the requirements. Faraday idling voltages reached the theoretical values only for $\beta \leq 1.7$; they were always lower for higher β values. The effect of unbalanced ionization and the resulting increase in conductivity was clearly

proven. The Hall voltages and the effective Hall parameter were always lower than the calculated values. Fluctuations due to plasma instabilities were measurable for $\beta > 1.7$. The insulation of the diffuser was found to be insufficient. Transl. by K.W.

N69-30945*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A BRUSHLESS DC TORQUER-DRIVEN REACTION WHEEL FOR SPACECRAFT ATTITUDE CONTROL

R. Fulcher Washington Jul. 1969 20 p refs

(NASA-TN-D-5265) Avail: CFSTI CSCL 10B

A further development of electromechanical direct drive systems for space applications, dc photoelectronic (brushless) commutation techniques have been applied to the design of a reaction wheel. The resulting prototype hardware, which also incorporates optimized mechanical features, is shown to compare favorably on a weight/power basis with currently used ac torquer-driven reaction wheels. Furthermore, full utilization of the brushless commutator has simplified and improved control systems by providing, within the reaction wheel itself, the control electronic functions of bidirectional rotation, torque level control, and power amplification. A test control system using a prototype brushless reaction wheel on a single-axis platform demonstrated excellent dynamic response and high pointing accuracy (within a few seconds of arc). Life testing of prototype hardware has been underway for 2 years. Author

N69-30971*# National Aeronautics and Space Administration, Washington, D.C.

AIRCRAFT TURBINE ENGINES: DESIGN AND OPERATION

Stefan Szczecinski Jul. 1969 944 p refs Transl. into English of the book "Lotnicze Silniki Turbinowe, Konstrukcja i Eksploatecja" Warsaw, Min. of Natl. Defence Press, 1965 p 1-463

(NASA-TT-F-12463; Rept-67-56028) Avail: CFSTI CSCL 10B

A survey of design in contemporary gas turbines for aircraft and examples of designs currently in operation are presented. Principal attention was devoted to engines serving as power plants for combat aircraft, but due consideration was given to engines for training planes, passenger liners, and helicopters. In the presentation of appropriate examples of designs, a description of the working and loading conditions for particular assemblies or parts, specifying also the methods currently in use for strength and dynamic calculations, materials, permissible stress intensity, and safety factors. The dynamic calculations for rotors, starter mechanisms, and automatic engine control systems are presented with the necessary abbreviations and simplifications while the greatest possible degree of accuracy is maintained in describing the phenomena occurring. Author

N69-31015# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.

STUDIES OF THE SOLAR ATMOSPHERIC GENERAL CIRCULATION Final Report, 2 Feb. 1966–31 Jan. 1969

Victor P. Starr 28 Feb. 1969 24 p refs

(Contract AF 19(628)-5816)

(AD-686471; AFCRL-69-0093) Avail: CFSTI CSCL 3/2

The research reviewed was directed toward the development of a method of objective forecasting of solar flare phenomena. This was done through efforts to construct mathematical models of the outer layers of the sun, to be solved by machine integration in a manner similar to the procedures used in meteorological forecasting on a hemispheric or global scale. In the solar case magnetic terms are included, and various other complicating factors are treated. One preliminary model was prepared for purposes of orientation. This much simplified model was solved largely by analytical methods. It indicated the general feasibility of the approach used, and displayed many details in agreement with observations. A second global two-layer model was designed and partially tested. It showed, when properly adjusted, an equatorial acceleration, a dynamo action which actually is probably too vigorous, and a tendency to oscillate with a period of the general order of the solar cycle. The two hemispheres showed a general opposing magnetic polarity. Further testing is now in progress. Author (TAB)

N69-31240*# Minnesota Mining and Mfg. Co., St. Paul, Minn. Space and Defense Products Dept.

SOLAR CELL CONTACT DEVELOPMENT Quarterly Report, 28 Dec. 1968-28 Mar. 1969

28 Mar. 1969 17 p refs

(Contract NAS5-11595)

(NASA-CR-103299; QR-3) Avail: CFSTI CSCL 10B

Contact degradation and sputter deposition of contact material were presented. Exposure of Ti–Ag contacts to an additional number of gaseous environments demonstrated the general porosity of thin Ag films to corrosive species and indicated the extent of the corrosion reaction. The environments included vapors of HCl, HF, H_2SO_4, wet and dry CO_2, and wet and dry Cl_2. Titanium metal was found to be reactive to some of these gases, to seawater, and to ordinary tap water. The corrosion reaction of Ti in aqueous NaOH was found to be concentration dependent, while the reaction rate was not found to be substantially different when Ti was coupled to Ag in solution. A sputtering system was assembled in which Ti and Ag can be sequentially sputtered in situ and where the sputtering targets can be precleaned prior to contact deposition. Deposition of Ti–Ag contacts by sputtering is in progress. Author

N69-31383# Signals Research and Development Establishment, Christchurch (England).

AN ASSESSMENT OF THE LONG TERM CAPACITOR REQUIREMENTS FOR STATIC POWER CONVERSION EQUIPMENTS

C. E. Mugford May 1968 20 p

(AD-686340; SRDE-68007) Avail: CFSTI CSCL 10/2

The recent trends in conversion equipments towards higher powers and smaller sizes highlights the need for more advanced components. The paper discusses the equipment designers requirements for capacitors in the next decade. It consists of three main sections dealing with commutation, filters and the environmental conditions of capacitors. Author (TAB)

N69-31461# Army Electronics Command, Fort Monmouth, N.J.

SEPARATOR MATERIALS FOR THE LITHIUM-CHLORINE BATTERY

David L. Beals and William H. Mapes Mar. 1969 18 p refs

(AD-686285; ECOM-3105) Avail: CFSTI CSCL 10/3

The objective of this study was to investigate a number of commercial ceramic materials as possible anode-cathode separator materials for a lithium-chlorine battery. It had been demonstrated that common insulating materials, such as those based on Al_2O_3, SiO_2, or organic materials, would fail due to high operating temperature (450C), corrosive environment experienced by the separator, or solubility in the molten salt electrolyte. Several promising materials were investigated in lithium-chlorine cells for periods of up to 284 hours during which the cell was continuously charge-discharge cycled. The materials showing the least corrosion at the conclusion of this investigation were binder-free BN, hot pressed AlN, and Hot pressed Si_3N_4. TAB

N69-31561# ARO, Inc., Arnold Air Force Station, Tenn.
COMPUTER ANALYSIS OF THE RELATIVE FLOW IN THE BLUNT-TRAILING-EDGE SUPERSONIC COMPRESSOR BLADING Final Report, Apr. 1967–Dec. 1968
J. W. Salvage AEDC May 1969 71 p refs
(Contract F40600-69-C-0001)
(AD-686406; AEDC-TR-69-42) Avail: CFSTI CSCL 13/7

The computer program presented was designed specifically for the analysis of the blunt-trailing-edge supersonic compressor. Beginning with flow property measurements obtained in a nonrotating coordinate system, streamtube boundaries are determined at each measuring plane. Then mass-averaged values of the flow properties in each streamtube are translated to a coordinate system rotating with the compressor rotor, and a particular one-dimensional flow model is imposed on each streamtube to describe the flow process through the rotor. The flow model includes analysis of shock loss and sudden expansion loss leading to an estimate of the additional loss occurring within the flow field of the rotor. Various other calculations are presented which are aimed at the analysis of data for accuracy and consistency. Author (TAB)

N69-31657*# AiResearch Mfg. Co., Phoenix, Ariz.
THE 1200-HZ BRAYTON ELECTRICAL RESEARCH COMPONENTS
James H. Dunn 19 Mar. 1969 327 p
(Contract NAS3-9427)
(NASA-CR-72564; APS-5288-R) Avail: CFSTI CSCL 10A

The electrical components for a 1200-Hz Brayton energy conversion system were designed and fabricated. These components consist of a high efficiency Rice four-pole brushless 10.5-KW alternator, a voltage regulator/exciter, and a parasitic load-type speed control. Together, these three units comprise the alternator research package. The alternator was designed with oil-mist lubricated ball bearings. However, the specifications require the minimization of the magnetic load unbalance on the bearings to permit the future application of gas lubricated bearings. Both series and shunt field control are provided in the voltage regulator/exciter to maintain steady-state regulation within ±1 percent of rated voltage with loads from 10 to 100 percent at 0.75 lagging power factor. The speed control is designed to maintain speed (frequency) regulation of 1200Hz ±1.0 percent under steady-state conditions. Author

N69-31688# Sandia Corp., Albuquerque, N.Mex.
PULSED POWER FROM EXPLOSIVE GENERATORS
M. Cowan and Eugene C. Cnare Apr. 1969 17 p refs Presented at Symp. on Eng. Probl. of Fusion Res., Los Alamos, N. Mex., 8-11 Apr. 1969 Sponsored by AEC
(SC-DC-69-1648; CONF-690407-2) Avail: CFSTI

For the past few years, explosive generators have undergone engineering development in connection with experimental programs being carried out at Sandia Laboratories. As a result, this technology has taken on a versatility not previously extant. Explosive generators may now be considered competitive with capacitor banks as a source of pulse power for a larger range of applications. Recent developments in characterizing performance capabilities of explosive generators along with techniques which extend the capabilities of a given generator design will be presented. A new explosive generator facility which allows isolation of the high-explosive effects will be described. Author (NSA)

N69-31788# Army Electronics Command, Fort Monmouth, N.J.
METHANOL-OXYGEN FUEL CELL SYSTEM DESIGN
James E. Wynn Mar. 1969 23 p refs
(AD-685857; ECOM-3096) Avail: CFSTI CSCL 10/2

The feasibility of fully fueled, no maintenance, alkaline methanol-oxygen cells has been investigated for low power, long life use. Silver-palladium oxide carbon anode and platinized carbon cathode structures are utilized in cell schemes using anion exchange membranes and electrically biased catalyzed nickel grids. This cell design has been incorporated into practical battery configurations and has shown to be an effective one for improved performance and life. In completely sealed cells wherein high concentrations of methanol are dissolved in the KOH electrolyte, the interaction of methanol at platinized carbon cathode structures is virtually eliminated with this improved design. Author (TAB)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N69-30428*# State Univ. of New York at Buffalo. Faculty of Health Sciences.
CENTER FOR THEORETICAL BIOLOGY
1968 140 p refs
(Grant NGR-33-015-016)
(NASA-CR-103206) Avail: CFSTI CSCL 06C

Detailed summaries are presented of the organization, research, and contributions in the area of theoretical biology. Specific sections deal in depth with the following areas of interest: nuclear and cytoplasmic inheritance; models of the central nervous system and sensory communication; receptor structure, function, and isolation; statistical mechanics in biophysical systems; symbolic relational systems; system theory and relational biology; theoretical pharmacology; theory of macromolecules; cell membranes; and quantum biochemistry. K.R.G.

N69-30473# NOLIT Publishing House, Belgrade (Yugoslavia).
RECOVERY OF IRRADIATED CELLS AND ORGANISMS BY NUCLEIC ACIDS [OZDRAVLJENJE OZRACENIH CELIJA I ORGANIZAMA POMOCU NUKLEINSKIH KISELINA]
Paul Pignon ed. 1967 173 p refs Transl. into ENGLISH of Bull. Inst. Nucl. Sci. "Boris Kidrich" (Belgrade), v. 17, no. 4/A, Suppl., 1966 Proc. of the Intern. Symp., Herceg Novi, Yugoslavia, 23–24 Jun. 1966 Translated and Published for the AEC and NSF
(AEC-tr-6846/4A) Avail: CFSTI

Three areas of interest were covered at the conference: repair of radiation damage, uptake and fate of nucleic acid, and the effect of exogenous nucleic acids and their precursors in irradiated cells. For individual titles, see N69-20474 through N69-30505.

N69-30474# NOLIT Publishing House, Belgrade (Yugoslavia).
REPAIR OF SINGLE AND DOUBLE BREAKS IN THE DNA OF MICROCCUS RADIODURANS EXPOSED TO X-RAYS
P. Alexander (Roy. Cancer Hospital, London) et al *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 1–5 refs (See N69-30473 17-04)
Avail: CFSTI

Enzyme-treated cells were lysed on an alkaline sucrose gradient and centrifuged to obtain single-stranded DNA. The molecular weight was calculated before and after irradiation. When the cells were lysed and the DNA denatured at different times after irradiation

the rate of repair of single breaks could be determined. The repair started immediately and proceeded rapidly after irradiation. By the end of the lag period 70% of the breaks were reconstituted, but the molecular weight was only attained when the DNA complement of the cell had doubled. NSA

N69-30475# NOLIT Publishing House, Belgrade (Yugoslavia).
STUDIES ON E. COLI MUTANTS DEFECTIVE IN DNA REPAIR
Richard Boyce (Yale Univ. School of Med.) et al *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 7–9 refs (See N69-30473 17-04)
Avail: CFSTI

Escherichia coli K12 mutants defective in DNA repair can be divided into two main classes, the excision mutants and the recombination deficient mutants. Effects of methylmethane sulfonate, mitomycin C, nitrogen mustard, UV radiation, and X radiation on the two classes of mutants are summarized in the form of a table. NSA

N69-30476# NOLIT Publishing House, Belgrade (Yugoslavia).
RECOVERY OF X-RAY INDUCED DAMAGE IN CHLAMYDOMONAS REINHARDI
Jana Hillova (Czech. Acad. of Sci., Brno) *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 11–15 refs (See N69-30473 17-04)
Avail: CFSTI

In experiments with fractionated X-ray doses, the algae were stored in water between two dose fractions for different periods of time (40 to 200 min) at 26°C under continuous illumination. Colony counts were made on agar plates 6 to 7 days after inoculation. The tabulated data show a survival value of 67.5% with a time interval of 200 min between the two doses of 7500 rad each; the survival value was 30.5% with a time interval of 40 min between the two doses. NSA

N69-30477# NOLIT Publishing House, Belgrade (Yugoslavia).
AN IN VITRO BONE MARROW SYSTEM FOR STUDYING RECOVERY FROM RADIATION INJURY
L. H. Smith (ORNL) *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 17–19 refs Supported by AEC (See N69-30473 17-04)
Avail: CFSTI

Some radiation injury recovery measures were applied to normal mouse bone marrow cells in vitro. These cells were chosen for study because they constitute a radiation sensitive tissue that is critical to survival of irradiated animals and because their reproductive capacity can be readily assessed and quantified by transplantation into syngeneic irradiated recipients. The primary goal was to develop an in vitro method whereby recovery measures could be tested on mouse bone marrow. For assessing the reproductive capacity of bone marrow cells, the method of ^{59}Fe uptake by the spleen was used. Many culture variables were tested, and the following optimal conditions were found for normal unirradiated cells: tissue culture medium 199 plus 25% mammalian serum; 5.0 to 50.0 $\times 10^6$ cells/ml; pH 6.8 to 7.6; and stationary cultures. Under these conditions, the major variable was temperature. The efficacy of tissue extracts, including heterologous DNA and RNA, was tested in the mouse marrow system. No substance was found which, when present in the post-radiation environment for up to 24 hours, will effect recovery from X-ray injury. K.R.G.

N69-30478# NOLIT Publishing House, Belgrade (Yugoslavia).
PHYSICO-CHEMICAL REPAIR OF THYMINE AND DEOXYRIBONUCLEIC ACID EXPOSED TO IONIZING RADIATION
V. Drasil (Czech. Acad. of Sci., Brno) et al *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 21–24 (See N69-30473 17-04)
Avail: CFSTI

Thymine dissolved in tritium-labeled water was irradiated. Exchangeable tritium was eliminated after repeated drying and dissolving in stable water; the activity remaining bound in the molecule was then measured. The total amount of tritium incorporated from the water into thymine and the products of its radiolysis were linearly proportional to the radiation dose and the specific activity of the tritium-labeled water. Analogous results were obtained with DNA in tritium-labeled water. NSA

N69-30479# NOLIT Publishing House, Belgrade (Yugoslavia).
RADIATION RECOVERY IN MAMMALIAN CELLS
M. M. Elkind (NIH) *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 25–29 refs (See N69-30473 17-04)
Avail: CFSTI

Log-phase populations of hamster cells were synchronized with a two-hour exposure to hydroxyurea. Cells were given a fractionated dose of 975 rad of X-rays and survival data were recorded in the form of a graph. Results indicate that: repair is weakly dependent on temperature; repair does not require oxygen; new protein synthesis is not required for repair; DNA synthesis is not required for repair; actinomycin D interferes with the expression of a restored capacity for sublethal damage. NSA

N69-30480# NOLIT Publishing House, Belgrade (Yugoslavia).
RESTORATION CONFERRED ON IRRADIATED BACTERIAL CELLS UPON COMPLETE TRANSFER OF UNIRRADIATED CHROMOSOME
Ivar Johansen (Norweg. Defence Res. Estab.) *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 31 (See N69-30473 17-04)
Avail: CFSTI

In the Hfr/F$^-$ mating system of *Escherichia coli* recombinants with an integrated distal male marker appear with a frequency of about 0.1. Analyses of the genetic constitution of these recombinants reveal that slightly less than 50% of their genome originates from the donor cells. X-irradiation of the recipient cells before mating has little effect on the distribution of male and female genetic material in the recombinants. Furthermore, the frequency of recombinants decreases with increasing dose, and the dose-response curve is not markedly different from the survival curve for recipient cells. The findings suggest that a major part of the lethal X-ray induced damage to bacteria may be ascribed to effects on the bacterial chromosome. NSA

N69-30481# NOLIT Publishing House, Belgrade (Yugoslavia).
RECOVERY PROCESSES IN X-IRRADIATED L-CELLS
Antun Han (Rudjer Boskovic Inst., Zagreb) et al *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 33–35 refs (See N69-30473 17-04)
Avail: CFSTI

When UV light was delivered a few hours before the first X-ray dose an inhibition in initial recovery occurred similar to that when UV light was delivered after the first X-ray dose. This indicated that the UV effect was not caused by a delay in repair processes, but that it was caused by high UV sensitivity of

structures or systems involved in recovery. Recovery was not altered when the replacement of thymine by bromo-uracil in cellular DNA was about 15%. Therefore, recovery in cells containing some bromo-uracil in DNA suggested that the mechanism of enhanced radiosensitivity was not associated with destruction of the mechanism underlying the repair process. Fluoro-uridine affected the synthesis of both DNA and RNA. NSA

N69-30482# NOLIT Publishing House, Belgrade (Yugoslavia).
DELAYED POST-IRRADIATION PHENOMENA IN CULTURES OF MURINE LEUKAEMIC LYMPHOBLASTS L 5178Y HYPERSENSITIVITY TO LOW DILUTIONS
J. Z. Beer (Inst. of Nucl. Res., Warsaw) et al *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 37–42 refs (See N69-30473 17-04)
Avail: CFSTI

Two strains of murine leukemic lymphoblasts differing in radiosensitivity were used. It was found that populations of the sensitive strain that survived several generations after X-radiation grew in cultures diluted below the lower limit of logarithmic growth at a rate much lower than the unirradiated populations. The difference in behavior between control and irradiated populations gradually decreased. The phenomenon of hypersensitivity to low dilutions made it possible to reveal a sublethal radiobiological lesion that was transferred in irradiation-surviving populations through several tens of generations. Possible causes of the radiobiological lesion and its repair are discussed. NSA

N69-30483# NOLIT Publishing House, Belgrade (Yugoslavia).
ABSORPTION AND FATE OF EXOGENOUS DNA IN LIVING SYSTEMS
L. Ledoux (Centre d'Etude de l'Energie Nucl., Mol, Belgium) et al *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 44–50 refs Supported jointly by EURATOM and CEN (See N69-30473 17-04)
Avail: CFSTI

The DNA-^{3}H D_2O from *B. subtilis* was injected intravenously in immature mice treated 28 hours earlier with oestradiol. Blood samples were taken at 0, 5, 10, and 60 minutes and analyzed in CsCl gradients. The results show that the DNA disappears rapidly from the blood without being degraded to acid-soluble components. However, some depolymerization occurs at the same time. It is concluded that exogenous DNA can be taken up by certain organs or tissues of living animals or plants, and in some cases it replicates and appears to be integrated into the cell genome. These results offer a biochemical basis for the effects of high molecular DNA on the fate of living cells. However, it is also concluded that the phenomena are very complex and might be different from organism to organism and even from organ to organ in a given organism. K.R.G.

N69-30484# NOLIT Publishing House, Belgrade (Yugoslavia).
FATE OF EXOGENOUS DNA IN CELLS IN VITRO
B. A. Neskovic (School of Med., Belgrade) et al *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 51-54 refs (See N69-30473 17-04)
Avail: CFSTI

The fate of exogenous DNA introduced into animal and bacteria cells is examined. Difficulties in using autoradiographical methods in this type of analysis are dealt with. Sixty mg of radioactive DNA per ml of medium was introduced in a monolayer culture of L-strain cells. The DNA was extracted by the method of Marmur (Suecca) from L cells grown in the presence of ^{32}P or thymidine ^{3}H for 48 hours. Two kinds of radioactivity were found in all the preparations not treated with DNA: (1) agglomerates of grains above the vacuolized parts of the cytoplasm, in 5% to 10% of the cells treated with DNA-^{32}P and in 0.5% to 1% of cells treated with DNA-^{3}H. These agglomerations were rarely found above the nuclei. The DNA-^{32}P was mostly found in multinucleated cells, while DNA-^{3}H was usually found in mononuclear cells; (2) individual grains above the cytoplasm and nucleus, 2 to 3 times more frequently than the background, randomly scattered, and unbound. K.R.G.

N69-30485# NOLIT Publishing House, Belgrade (Yugoslavia).
LOCALIZATION OF INCORPORATED DNA IN HOST CELL
M. Hill (Czech. Acad. of Sci., Brno) *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 55–58 refs (See N69-30473 17-04)
Avail: CFSTI

A series of experiments was performed to investigate the assumed mechanism operating in host cells which is capable of deciding whether incorporated foreign DNA will be fixed in the nucleus, or released and metabolized. The following patterns of DNA incorporation into the recipient cell were found in various sytems in vitro: (1) DNA plus recipient cell: for lymphocytes with uptake of single DNA molecules, accumulation in the nucleus; for L cells with uptake of single DNA molecules, uniform distribution in the nucleus and cytoplasm; and (2) donor cells plus recipient cells: with uptake of DNA molecules and/or chromosome fragments released from damaged donors, accumulation in the nucleolar-associated chromatin; with nuclear fusion, formation of synkaryon. In light of findings on translocation phenomena in donor-recipient cell systems in vitro, it is concluded that similar events probably take place in vivo. K.R.G.

N69-30486# NOLIT Publishing House, Belgrade (Yugoslavia).
THE FATE OF EXOGENOUS DNA IN UV-IRRADIATED L CELLS
O. Djordjevic (Boris Kidric Inst. of Nucl. Sci., Beograd) et al *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 59–62 refs (See N69-30473 17-04)
Avail: CFSTI

Highly polymerized ^{14}C-DNA was extracted from L cells labeled with ^{14}C-thymidine. L cells in the logarithmic phase of growth were uv-irradiated and resuspended in calf serum containing ^{14}C-DNA. The total radioactivity of the medium decreased with incubation time for both normal and irradiated cells, but at a faster rate in non-irradiated cultures. After 24 hours of incubation 80% of non-irradiated cells were labeled; after the same interval in irradiated cultures only 55% of the cells were labeled. The labeled chromosomes found 24 hrs after incubation of nonirradiated and irradiated cells with ^{14}C-DNA indicated strongly that exogenous ^{14}C-DNA or its fragments were incorporated into the DNA of recipient cells. NSA

N69-30487# NOLIT Publishing House, Belgrade (Yugoslavia).
EFFECTS OF EXOGENOUS DNA ON IRRADIATED MAMMALIAN CELLS
L. A. Smets (Nijmegen Univ., Netherlands) *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 65–67 (See N69-30473 17-04)
Avail: CFSTI

Indirect evidence suggested the involvement of DNases in the alterations in DNA metabolism after ionizing radiation. The observed turnover in nascent strands following X-ray treatment of cells includes not only additional synthesis but also breakdown of existing DNA by DNA-splitting enzymes. This turnover will hardly decrease initial damage since during neosynthesis damage in templates could be copied, giving rise to double hit instead of randomly scattered single hit damages. It is proposed that exogenous DNA reverts irradiation effects according to the enzyme capture

hypothesis. This hypothesis holds that DNases are occupied by the exogenous substrate after its incorporation and thus are prevented from damaging cellular DNA, either directly or during radiation-induced turnover in nascent strands. The relation of the findings with increased survival observed by others is not yet clear.
Author (NSA)

N69-30488# NOLIT Publishing House, Belgrade (Yugoslavia).
CLONE SIZE DISTRIBUTION OF HeLa CELLS TREATED WITH DNA PRECURSORS
A. H. W. Nias (Christie Hospital and Holt Radium Inst., Manchester, England) et al *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 69–72 (See N69-30473 17-04)
Avail: CFSTI

HeLa cells were irradiated and an equimolar solution of the four deoxyribonucleosides was added to the culture medium; the cells were cultured for ten days before fixation. The mean colony counts are tabulated; the percentage survival of the irradiated cells is compared with controls in both treated and untreated groups. With a concentration of 10 μg/ml of nucleosides, the clone size distribution showed no difference between the treated and untreated cell populations and no effect on the proliferation rates. The increased survival percentage obtained with this dosage can therefore be accepted as a true restoration of radiation damage.
NSA

N69-30489# NOLIT Publishing House, Belgrade (Yugoslavia).
REPAIR OF LETHAL RADIATION DAMAGE IN L CELLS BY DEOXYRIBONUCLEOTIDES, AS RELATED TO CELL CYCLE
D. Petrovic (Rudjer Boskovic Inst., Zagreb) et al *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 73–75 refs (See N69-30473 17-04)
Avail: CFSTI

The L cells were synchronized and about 80% were in mitosis. Culture flasks were irradiated hourly with 500 R during the first cell cycle. After irradiation, an equimolar solution of the four deoxyribonucleotides was added to half of the flasks of each lot and all samples were then incubated for two weeks and the colonies counted. The phases of the cell cycle were determined by labeling the synchronized cells for 20 min with tritium-labeled thymidine and the use of autoradiography. A histogram is presented to show the survival of cells irradiated with 500 R at different times after mitosis and the restorative effect of the nucleotides. The cells are about ten times more radioresistant in the G_1 period than in the middle of the S period. The restorative effect of the nucleotides increases toward the S period and remains quite high during the whole of S with a drop in the middle of it. In G_1 there is no restorative effect.
NSA

N69-30490# NOLIT Publishing House, Belgrade (Yugoslavia).
THE EFFECT OF EXOGENOUS DEOXYRIBONUCLEIC ACIDS ON THE MITOSIS OF IRRADIATED AND NON-IRRADIATED MERISTEMATIC CELLS OF VICIA FABA
J. Slotova (Czech. Acad. of Sci., Brno) *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 77–81 refs (See N69-30473 17-04)
Avail: CFSTI

Primary roots of *Vicia faba* were irradiated on the sixth day after germination. After irradiation the roots were transferred to a DNA solution in which they remained for 2, 4, 6, 8, 16, and 24 hrs. A decrease of mitotic activity in irradiated root cells was recorded for 2, 4, and 6 hrs. For intervals of 8 and 16 hrs a gradual increase occurred so that the mitotic activities of the experimental and control groups were equal 24 hrs after irradiation. The decrease in mitotic activity of the roots kept in DNA solution was not as pronounced during the early intervals and the mitotic index reached the value of the control group sooner. The effect was more pronounced in roots cultivated in isologous DNA after irradiation.
NSA

N69-30491# NOLIT Publishing House, Belgrade (Yugoslavia).
RESTORATION OF X-RAY DAMAGED PLANT TISSUE CULTURES BY NUCLEIC ACIDS AND RELATED PRODUCTS
M. I. Duarte (Paris Univ.) et al *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 83–89 refs (See N69-30473 17-04)
Avail: CFSTI

A review of the literature on plant growth-stimulating factors and their influence on restoration of radiation damage is presented. It was found that coconut milk, which contains indolbacetic acid and a kinin derived from nucleic acids, was not able to restore radiation damage in Scorzonera crown gall. However, a fraction prepared from yeast RNA promoted restoration of radiation damage. An extract of tobacco leaves was shown to be capable of restoring cultures of tobacco crown gall tissue after irradiation. It was thought that a kinin derived from nucleic acids was responsible for the restoring effect.
NSA

N69-30492# NOLIT Publishing House, Belgrade (Yugoslavia).
SOME ASPECTS OF THE EFFECTS OF NUCLEIC ACIDS ON SURVIVAL OF IRRADIATED ANIMALS
T. Wilczok (Inst. of Oncology, Gliwice, Poland) *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 91–96 (See N69-30473 17-04)
Avail: CFSTI

A review of the literature on radioprotective effects of nucleic acids is presented. Results obtained by various workers from studies on protective effects of homologous and heterologous DNA against lethal doses of radiation are discussed. Studies on molecular weights of DNA showed that DNA of higher molecular weights has greater therapeutic efficiency. Effects of γ radiation on the differential blood count of rats were studied; following treatment with DNA the blood picture was normal after the fifth day following irradiation, but seven to twelve days were required for restoration when sodium chloride was substituted for DNA. Studies on post-irradiation injection of tritium-labeled DNA led to the following hypothesis: DNA can circulate in the blood stream in a native macromolecular state where it adsorbs to lymphocytes; these cells or their fragments carry it to the bone marrow and the lymphatic tissues; thus the exogenous DNA is made available in situ to cells and tissues for repair of radiation damage. Effects of DNA on immunological properties of irradiated animals are discussed.
NSA

N69-30493# NOLIT Publishing House, Belgrade (Yugoslavia).
RECOVERY EFFECT OF HOMOLOGOUS AND HETEROLOGOUS DNA FROM DIFFERENT ORGANS INJECTED INTO TOTAL-BODY IRRADIATED (600 R) INFANTILE MALE RATS AND ADULT MALE RATS
N. Savkovic (Boris Kidric Inst. of Nucl. Sci., Vinca) *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 98–102 (See N69-30473 17-04)
Avail: CFSTI

Rats and mice of different ages were exposed to an X-ray dose of 600 R; one half of each group was treated with DNA. Results, presented in the form of graphs, show that in all cases the survival of animals treated with DNA was greater than that of control animals. Results were similar for homologous and heterologous DNA extracted from liver, spleen, and thymus.
NSA

N69-30494# NOLIT Publishing House, Belgrade (Yugoslavia).
THE EFFECT OF NATIVE, DENATURED, RENATURED AND DEGRADED DNA ON THE SURVIVAL OF LETHALLY IRRADIATED RATS
J. Mendecki (Inst. of Oncology, Gliwice, Poland) et al *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 103–106 (See N69-30473 17-04)
Avail: CFSTI

Rats were given 1000 R of γ radiation and injected intraperitoneally with the following DNA preparations: native, denatured, renatured, degraded native, degraded denatured, single stranded, and DNase-treated. Control rats were injected with sodium chloride. A table is presented to show percent survival after 30 days of the rats treated with different DNA preparations. Control animals died within 19 days. After 30 days, the survival of rats given native DNA was 62%; that of rats given denatured DNA was 57%; renatured, 60%; degraded native, 0%; degraded denatured, 0%; single stranded, 32%; and DNase-treated, 0%. The significance of the molecular weights of the various DNA preparations in relation to survival of rats is discussed. NSA

N69-30496# NOLIT Publishing House, Belgrade (Yugoslavia).
RESEARCH ON THE KINETICS OF DEATH AFTER WHOLE-BODY IRRADIATION WITH X-RAYS OR GAMMA-RAYS
H. Naumann (Inst. of Oncology, Gliwice, Poland) et al *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 107–110 (See N69-30473 17-04)
Avail: CFSTI

Rats were irradiated at various dose rates and treated with DNA or sodium chloride. In attempting to get a maximum number of survivals of animals with radiation sickness after LD 100 treatment with DNA, the radiobiological threshold effect was obtained within a dose range of 1 to 2 R/min. Animals irradiated with LD 100 at high dose rates did not survive the radiation sickness despite DNA treatment, while rats given the same total dose but at dose rates of only 1 to 2 R/min exhibited 30 to 80% survival when treated with DNA. Control rats treated with sodium chloride all died within a period of 15 to 30 days. NSA

N69-30496# NOLIT Publishing House, Belgrade (Yugoslavia).
DNA REPAIR OF RADIATION DAMAGE IN THE CIRCULATING BLOOD OF RATS
Stanislaw Gotba (Inst. of Oncology, Gliwice, Poland) et al *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 111–113 (See N69-30473 17-04)
Avail: CFSTI

Exogenous DNA administered to rats after irradiation with a lethal dose of γ radiation had a significant effect on the survival weight and the recovery of erythrocytes, hemoglobin and white cell count in the circulating blood. Highly polymerized DNA from calf thymus was injected intraperitoneally within 48 hrs after irradiation. Control rats were given sodium chloride. Seven days after irradiation the erythrocyte count began to decrease; however, within 30 days the count returned to normal in the DNA-treated rats. In control rats the count decreased and death occurred within three weeks. The leukocyte count decreased drastically during the first 24 hrs after irradiation in all rats, reaching its lowest value after three days. From the 14th day after irradiation a great increase in leukocyte count was observed in the DNA-treated rats, but not in control rats. NSA

N69-30497# NOLIT Publishing House, Belgrade (Yugoslavia).
SPONTANEOUS AND RADIATION INDUCED CHROMOSOME ABERRATIONS IN THE BONE MARROW OF RATS IN VIVO
V. Jankovic-Stejin (Boris Kidric Inst. of Nucl. Sci., Vinca) et al *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 115–119 refs (See N69-30473 17-04)
Avail: CFSTI

Chromosome examinations were made on four groups of rats: normal, DNA-treated, X-irradiated, DNA-treated and X-irradiated. The bone marrow of rats treated with DNA contained a higher frequency of abnormal cells and also a higher frequency of aberrations per cell than that of normal rats. Examination of cells from bone marrow of irradiated rats revealed changes in number and arrangement of chromosomes and structural damage. The most frequent aberrations were acentric chromosomes formed by breakage in the centromere zone. All types of aberrations occurred with a frequency considerably greater than that of control animals. In irradiated animals treated with DNA the frequency of aberrations was lower. NSA

N69-30498# NOLIT Publishing House, Belgrade (Yugoslavia).
THE EFFECT OF DNA AND OTHER HUMORAL FACTORS ON RECOVERY OF HAEMATOPOIETIC TISSUE
Vera Juraskova (Czech. Acad. of Sci., Brno) et al *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 121–125 refs (See N69-30473 17-04)
Avail: CFSTI

Mice were given a 650 R dose of X radiation and were then injected intraperitoneally with DNA, milk, thymidylic acid, and ascites tumor cells. Control mice were given saline solution. Recovery of hematopoietic tissue was determined using the spleen colony method. The tabulated results show that all substances increased the number of colonies. NSA

N69-30499# NOLIT Publishing House, Belgrade (Yugoslavia).
RECOVERY OF REPRODUCTIVE ABILITY BY HOMOLOGOUS TESTES, LIVER, SPLEEN, THYMUS AND KIDNEY DNA OF RATS IRRADIATED DURING THE INFANTILE PERIOD
N. Savkovic (Boris Kidric Inst. of Nucl. Sci., Vinca) *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 127–132 (See N69-30473 17-04)
Avail: CFSTI

Male rats, aged 8 and 17 days, were given 600 R of X-radiation. One group was treated with DNA extracted from kidney, liver, spleen, testes, and thymus. On reaching maturity the rats were mated with normal females. Fertility of males was estimated from the number of pregnant females and histological examination of the reproductive organs. Results showed that it was possible. Results showed that reproductive organs recovered from radiation damage when treated with DNA from the various organs. It is thought that nucleic acids repair the structure of the damaged nucleic acids in the irradiated organism. NSA

N69-30500# NOLIT Publishing House, Belgrade (Yugoslavia).
RECOVERY EFFECT OF HIGHLY POLYMERIZED HOMOLOGOUS TESTIS AND LIVER DEOXYRIBONUCLEIC ACID (DNA) ON THE SEMINIFEROUS EPITHELIUM OF X-IRRADIATED RATS
A. Popovic (Boris Kidric Inst. of Nucl. Sci., Vinca) et al *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 133–137 refs (See N69-30473 17-04)
Avail: CFSTI

Male rats were X-irradiated with doses of 500 and 750 R. DNA from testis was injected intraperitoneally into rats given 500 R, and DNA from liver was injected into rats given 750 R. Microscopic examination of testes showed that in rats treated with DNA there was less damage to the seminiferous epithelium and greater survival of spermatogonia and spermatocytes. NSA

N69-30501# NOLIT Publishing House, Belgrade (Yugoslavia).
RESTORATION AND ENHANCEMENT OF ANTIBODY SYNTHESIS BY NUCLEIC ACID DIGESTS AND COLCHICINE
Bernard N. Jaroslow (Argonne Natl. Lab.) *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 139–145 refs (See N69-30473 17-04)
Avail: CFSTI

The effects of colchicine on the hemolysin response were tested in X-irradiated and unirradiated rabbits. It was observed that colchicine in progressively increasing amounts stimulated the production of hemolysin at higher rates in both irradiated and unirradiated groups, but the length of the latent period and the duration of antibody production was not modified by colchicine. The role of nucleic acids in these phenomena is discussed. It is believed that cytotoxic agents enhance antibody formation by supplying extra amounts of nucleic acid degradation products that stimulate cells to produce appropriate enzymes for nucleic acid synthesis, and in the presence of antigen the processes leading to antibody production are initiated. NSA

N69-30502# NOLIT Publishing House, Belgrade (Yugoslavia).
RESTORATION OF THE ANTIBODY-FORMING CAPACITY OF IRRADIATED RATS BY MEANS OF NUCLEIC ACIDS
Miroslav M. Simic (Boris Kidric Inst. of Nucl. Sci., Vinca) et al *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 147–150 refs (See N69-30473 17-04)
Avail: CFSTI

Rats were given 400 to 600 R of X-radiation one or two days before immunization with sheep erythrocytes. They were given nucleic acid preparations from the day of irradiation through four or five days. Results demonstrated that only a fraction of the total damage caused by radiation can be restored by postirradiation treatment with nucleic acids from spleens of homologous donor rats, while the major part of the injury is irreparable under such experimental conditions. The experiment in which both DNA and RNA, isolated from spleen of preimmunized rats, were simultaneously administered after irradiation, strongly suggests that specific preimmunization of prospective nucleic acid donors can increase the degree of restoration of the hemolysin response in irradiated rats. NSA

N69-30503# NOLIT Publishing House, Belgrade (Yugoslavia).
EARLY EFFECTS OF THE HOMOLOGOUS DNA OF IRRADIATED L-STRAIN CELLS
B. A. Naskovic (School of Med., Beograd) et al *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 151–154 refs (See N69-30473 17-04)
Avail: CFSTI

The DNA was introduced into a culture of L cells immediately after the cells were γ-irradiated with a dose of 700 rads. Photomicrographs were made at regular intervals for ten days. The photographs were analyzed for duration of interphase, transition from one interphase to the next, time when the first normal mitosis appears, time when endoreduplication appears, time when pathologic mitosis appears, and number of cells one hour after irradiation and after 41, 144, 202, and 228 hours. The effect of radiation was to slow down the mitotic process during the first 48 hrs. The number of cells in DNA-treated cultures increased by 100% in 41 hrs. The first appearance of endoreduplication of chromosomes occurred after 19 hrs in cells with exogenous DNA, and at the 25th hr in cells without exogenous DNA. NSA

N69-30504# NOLIT Publishing House, Belgrade (Yugoslavia).
THE EFFECT OF ISOLOGOUS DNA ON THE METABOLISM OF DNA IN UV-IRRADIATED L-CELLS
Lj. Kostic (Boris Kidric Inst. of Nucl. Sci., Vinca) et al *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids 1967 p 155–158 refs (See N69-30473 17-04)
Avail: CFSTI

The L cells were irradiated with UV light in the logarithmic phase of growth. Survival was followed by counting cells cultivated in suspension. For metabolism studies irradiated and nonirradiated cells were plated in a medium containing ^{14}C-DNA. The survival of L cells was about 50% following UV irradiation. When DNA was added to the irradiated culture immediately after irradiation the survival rate was 86% four days after irradiation. NSA

N69-30505# NOLIT Publishing House, Belgrade (Yugoslavia).
EFFECT OF HOMOLOGOUS TESTIS DEOXYRIBONUCLEIC ACID ON THE TESTIS CELL RIBONUCLEIC ACID METABOLISM OF LETHALLY IRRADIATED RATS
Aleksandar Becarevic (Boris Kidric Inst. of Nucl. Sci., Vinca) et al *In its* Recovery of Irradiated Cells and Organisms by Nucleic Acids p 159–163 refs (See N69-30473 17-04)
Avail: CFSTI

Rats were given 850 R of X-radiation, and DNA was administered to irradiated and nonirradiated rats. Before killing, each animal was injected intraperitoneally with radioactive phosphate. All animals were sacrificed 29 hrs after irradiation or administration of DNA. Graphs are presented to show metabolic activity of RNA in testis cells. Results showed that irradiation strongly inhibited the capacity of testis cells to incorporate radioactive phosphorus into its RNA, but the decrease of incorporation was particularly pronounced in the ribosomal RNA. However, the radioinduced metabolic lesion was reduced by treatment with native homologous testis DNA. NSA

N69-30688 North Carolina Univ., Chapel Hill.
BLOOD FLOW AND OXYGEN CONSUMPTION IN RESTING SKELETAL MUSCLE
Gideon Beer (Ph.D. Thesis) 1968 140 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-1576

Blood flow to the muscle was controlled by a perfusion pump; measurements were made of blood pressure, arterial and venous oxygen contents, arterial and venous lactate contents, and CFC. Resting skeletal muscles produced lactate at rates ranging from 0.20 to 2.10 μM/min × 100 gm. Reduction of blood flow was associated with higher venous lactate levels. Lactate production was increased when moderate reduction of blood flow was imposed and decreased when flow reduction was substantial. An absolute relationship between blood flow (oxygen supply) and lactate production in the resting muscle could not be obtained. Oxygen deficits incurred during periods of reduced flow were never accurately repaid when blood flow was restored. The results indicate that the extraction of oxygen is closely associated with the capillary surface area available for filtration and diffusion, and that oxygen consumption of the muscle is dependent on the tissue perfusion at the microcirculatory level. Dissert. Abstr.

N69-30695*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A MATHEMATICAL MODEL OF THE EFFECT OF A PREDATOR ON SPECIES DIVERSITY
J. N. Yang and C. R. Weston 15 Jun. 1969 22 p refs
(Contract NAS7-100)
(NASA-CR-103242; JPL-TR-32-1389) Avail: CFSTI CSCL 08C

The presence of two species in the same environment with a common limiting resource is paradoxical if competition for the limiting resource is the only consideration: one or the other of the species must be eliminated. This analysis shows that a normally unsuccessful competitor for the limiting resource may persist when there is a predator on the otherwise successful species. The modified assumption and different parametric values which are considered do not alter this generalization. The working model is of bacteria growing in a chemostat; however, there is no reason to assume the resultant conclusions are restricted to a bacterial system, an experimental situation, or terrestrial organisms. Author

N69-30701# Joint Publications Research Service, Washington, D.C.
RADIOBIOLOGY, VOLUME 8, NO. 3
Nov. 1968 208 p refs Transl. into ENGLISH of Radiobiologiva (Moscow), v. 8, no. 3, 1968 Transl. for the AEC (AEC-TR-6916) Avail: CFSTI

Radiobiological studies on cells, seeds, and animals are presented. For individual titles, see N69-30702 through N69-30721.

N69-30702# Joint Publications Research Service, Washington, D.C.
SOME ASPECTS OF THE PROTECTION OF NUCLEOPROTEINS FROM THE INFLUENCE OF IONIZING RADIATION
A. N. Pisarevskii et al *In its* Radiobiology, vol. 8, no. 3, 1968 p 1–11 refs (See N69-30701 17-04)
Avail: CFSTI

The comparative radiosensitivity of deoxyribonucleoprotein (DNP) was studied in the gel and condensed states. It was shown that the radioresistance of formed nucleoprotein strands is increased by one to two orders of magnitude. The introduction of a number of protective substances into a DNP gel leads to an increase in the critical dose leading to loss of the structure-forming properties. The best protective ability is possessed by AET and MPA and gallates. Irradiation of DNP gels by doses below the critical dose not lead to any change in the number of structuromechanical properties, if protective substances are introduced into the DNP gels before irradiation. The greatest activity is possessed by FINAM. In the irradiation of condensed DNP structures, the change in the relaxation properties is entirely suppressed when AET and MPA are introduced into solution. Author

N69-30703# Joint Publications Research Service, Washington, D.C.
INFLUENCE OF IRRADIATION ON THE COMPOSITION OF MESSENGER RNA DURING EARLY LOACH EMBRYOGENESIS
S. R. Umanskii *In its* Radiobiology, vol. 8, no. 3 1968 p 12–22 refs (See N69-30701 17-04)
Avail: CFSTI

The population of RNA in normal and irradiated loach embryos was compared at various stages of development by the method of artificial DNA–RNA hybridization. It was shown that the activation of new genes during early loach embryogenesis is accomplished periodically. The periods of activation of the genes coincide with the periods of morphogenetic activity of the nuclei. Irradiation before the beginning of gene activation almost entirely suppresses this process, at the same time without producing a repression of already active genes. Author

N69-30704# Joint Publications Research Service, Washington, D.C.
URINE PROTEINS DURING ACUTE RADIATION SICKNESS OF ANIMALS
G. A. Sadgenidze et al *In its* Radiobilogy, Vol. 8, No. 3 1968 p 23–33 refs (See N69-30701 17-04)
Avail: CFSTI

The urine proteins of intact rats of the Avgust line and animals subjected to whole-body irradiation by the γ-rays of ^{60}Co, were subjected to an electro- and immunoelectrophoretic investigation. Cross-exhausted and unexhausted rabbit immune sera against uroproteins of intact and irradiated animals, as well as against proteins of the blood, mitochondria, microsomes, and hyaloplasm of kidney cells, were used to develop the electrophoretograms. In the uroproteins of the intact rats, six fractions differing in electrophoretic mobility were detected, containing 11 antigens, five of which were represented by blood serum proteins, while six were uroproteins specific for the urine, also determined in the proteins of the hyaloplasm and microsomes of kidney cells. Radiation sickness of the animals is accompanied by phase changes in the kidney function. Author

N69-30705# Joint Publications Research Service, Washington, D.C.
INFLUENCE OF GALASCORBIN ON THE RESPIRATION AND OXIDATIVE PHOSPHORYLATION OF LIVER MITOCHONDRIA AFTER IRRADIATION OF ANIMALS
E. F. Shamrai et al *In its* Radiobiology, vol. 8, no. 3 p 34–38 refs (See N69-30701 17-04)
Avail: CFSTI

In radiation sickness, disturbances of the intracellular metabolism are observed, including the energy metabolism, lying at the basis of all the vital processes. The question of the influence of ionizing radiation upon the processes of tissue metabolism and oxidative phosphorylation has been insufficiently studied. Determining the indices of the energy metabolism after various types of irradiation (local and total) and various doses (sublethal and lethal), as well as determining the possibility of influencing these processes by the use of a physiological complex of vitamins C and P (galascorbin) were studied. Author

N69-30706# Joint Publications Research Serivce, Washington, D.C.
POSTRADIATION CHANGES OF MOUSE AND RAT BONE MARROW CELLS DURING INCUBATION IN VITRO
L. A. Kharlamova *In its* Radiobiology, vol. 8, no. 3 1968 p 39–46 refs (See N69-30701 17-04)
Avail: CFSTI

The dynamics of the inactivation, death, and lysis of bone marrow cells was studied in nonirradiated and irradiated suspensions incubated at 37° in vitro. The dynamics of inactivation (loss of ability for unlimited multiplication) of hematogenic stem cells in mouse bone marrow suspensions was determined by the method of spleen colonies. Death and lysis of nucleated cells were judged according to the decrease in the number of cells that were not stained by eosin and were not lysed. It was established that the kinetic principles of these processes are the same. Irradiation at a dose of 100 and 190 r led to an acceleration of the inactivation of those stem cells which retained their ability for unlimited division immediately after irradiation. An acceleration of the processes of death and lysis of nucleated cells in vitro was observed only in the case of irradiation at doses of 1000 r and more. Author

N69-30707# Joint Publications Research Service, Washington, D.C.
STUDY OF THE DIRECT AND REMOTE EFFECTS OF RADIATION ON BONE MARROW
A. L. Vygodskaya et al *In Its* Radiobiology, Vol. 8, No. 3 1968 p 47-59 (See N69-30701 17-04) refs
Avail: CFSTI

Cell destruction and the change in the number of cells of different fractions in rat bone marrow under the influence of direct and remote action of radiation during the first two days after irradiation at a dose of 1000 r with one limb shielded were studied. The existence of remote influences of radiation upon hematogenic tissue, manifested in a substantial cell destruction in the shielded bone marrow, was established. It was shown that the remote effect is due to a sharp decrease in the number of erythroid cells and a certain decrease in the number of myeloid cells. The number of lymphocytes in the shielded bone marrow does not change significantly. The causes of the drop in the number of cells of different fractions of the shielded and irradiated bone marrow are analyzed. Author

N69-30708# Joint Publications Research Service, Washington, D.C.

COMPARATIVE STUDY OF THE EFFECTS OF X-RAY AND GAMMA-RADIATION ON THE SURVIVAL OF RATS UNDER CONDITIONS OF NONUNIFORM INFLUENCES

G. M. Avetisov *In its* Radiobiology, Vol. 8, No. 3 1968 p 60–65 (See N69-30701 17-04) refs

Avail: CFSTI

The peculiarities of the biological effects of X-ray and γ-radiations were demonstrated in experiments on rats by comparing them under conditions of nonuniform influences. A consideration of the spatial distribution of the tissue doses makes it possible to explain the qualitative and quantitative peculiarities of the course of radiation injury in nonuniform fields. In a comparison of the biological effectiveness of different types of radiations, a strict consideration of the spatial distribution of doses is needed. Author

N69-30709# Joint Publications Research Service, Washington, D.C.

RECOVERY OF THE FETUS AND PLACENTA AFTER RADIATION INFLUENCE

V. E. Kogan *In its* Radiobiology, Vol. 8, No. 3 1968 p 66-74 (See N69-30701 17-04) refs

Avail: CFSTI

The change in the state of fetuses and placentas was studied 3-7-9 days after irradiation of female rats on the tenth day of pregnancy at a dose of 25 r on the 13th, 17th, and 19th days of pregnancy. It was shown that on the 13th day of pregnancy, the vascularization of the fetal placenta is reduced, and the lifetime of the fetuses under conditions of total oxygen starvation is shortened (69.7 minutes in the experimental group, compared with 104.9 minutes in the control). Subsequently, a gradual repair of the vascular disorders in the placenta is observed: by the 17th day of pregnancy, no underdevelopment of the fetal vascular network in the labyrinth portion of the irradiated placentas is detected. Normalization of the response of the fetuses to total oxygen starvation does not set in until the 19th day of pregnancy. Thus, together with a high radiation vulnerability of the fetus, a substantial ability for repair after the disturbances of development is detected. Author

N69-30710# Joint Publications Research Service, Washington, D.C.

RADIOSENSITIVITY OF DEVELOPING TENCH EMBRYOS (TINCA TINCA L.)

I. V. Kulikov et al *In its* Radiobiology, Vol. 8, No. 3 1968 p 75-81 (See N69-30701 17-04) refs

Avail: CFSTI

The effects of aqueous solutions of ^{90}Sr and ^{90}Y and external irradiation by the γ-rays of cobalt -60 upon the embryonic development of the tench were studied under laboratory conditions. Incubation of fertilized tench roe in aqueous solutions of ^{90}Sr and ^{90}Y with a concentration from 10^{-10} to 10^{-8} curie/liter has no appreciable effect either upon the rate of development of the embryos or upon the quantitatively yield of normal and abnormal prelarvae from this roe. The survival rate of the prelarvae for 10 days after hatching from the roe incubated in radioactive water does not differ from the control. The prelarvae that hatched from the roe incubated in radioactive solutions proved to be just as resistant to supplementary external γ-irradiation (dose 800 r) as the controls. Author

N69-30711# Joint Publications Research Service, Washington, D.C.

RADIOSENSITIVITY OF THE MEMBRANES OF ISOLATED NUCLEI OF NERVE AND GLIAL CELLS

K. Sh. Nadareishvili et al *In its* Radiobiology, Vol. 8, No. 3 1968 p 82-91 (See N69-30701 17-04) refs

Avail: CFSTI

The kinetics of the hypotonic and alkaline decomposition of isolated nuclei obtained from the brains of four-week-old rats was studied. The nuclei were isolated by the method of Shobo with modifications. A suspension of nuclei in an isotonic sucrose solution was irradiated at 1.5°-2° C, then diluted with 0.25 percent neutral or alkaline NaCl solution, and the kinetics of the decomposition of the nuclei determined at room temperature. The number of nuclei in suspension was counted both microscopically and with an electronic particle counter. The experiments indicated that a statistically significant radiation effect is detected at a dose of 500 r for nuclei of astrocytes and at 1000 r for the nuclei of neurons and oligodendrocytes. Author

N69-30712# Joint Publications Research Service, Washington, D.C.

PHYSIOLOGICAL ANALYSIS OF THE ROLE OF THE SYNAPSE IN DISTURBANCES OF THE ACTIVITY OF THE NEUROMUSCULAR APPARATUS AFTER IRRADIATION

A. E. Ulyanitskaya *In its* Radiobiology, Vol. 8, No. 3 1968 p 92–98 refs (See N69-30701 17-04)

Avail: CFSTI

In irradiation of a neuromuscular preparation of *m. sartonius–n. ischiadicus* of the frog at a dose of 18–20 krad, a distinct decrease in the work capacity of the muscle begins, detectable according to its contraction in response to stimulation of a motor nerve. At the same time, in the case of direct stimulation the work capacity of the muscle does not differ from the norm. A dose of 18–20 krad does not produce any changes either in the threshold of excitation or in the action potential of the nerve. The action potentials of the muscle in the case of stimulation of a motor nerve become lower than in the control. In the case of direct stimulation of the muscle they are higher, producing an initial deterioration of the work of the muscle in response to stimulation of a motor nerve. Such a dose does not lower the work capacity either of the motor nerve or of the excitable muscle membrane. Consequently, a disruption of the myoneural synaptic transmission is responsible for the primary injurious effect observed immediately after irradiation. Author

N69-30713# Joint Publications Research Service, Washington, D.C.

SOME DISPUTED QUESTIONS IN THE PROBLEM OF POST RADIATION RECOVERY OF THE CHROMOSOMES

N. V. Luchnik *In its* Radiobiology, Vol. 8, No. 3 1968 p 99-111 (See N69-30701 17-04) refs

Avail: CFSTI

In this article, the term recovery is used to denote nonrealization of latent damages, a consideration of which is limited to the cytogenetic level. Evidence is cited against the idea that the formation of observable chromosome aberrations is based upon true breaks. Most of the facts support the correctness of the template theory. The impossibility, without making more or less arbitrary assumptions, of determining the rate of recovery and time of realization using existing facilities was demonstrated. The results of experiments indicating that cellular and local recovery involves processes that occur at the presynthetic and synthetic stages of the cellular cycle, respectively, were analyzed. Possible molecular mechanisms of both types of recovery are discussed. Author

N69-30714# Joint Publications Research Service, Washington, D.C.

LUMINESCENCE-CYTOCHEMICAL INVESTIGATION OF THE EFFECTS OF GAMMA-RAYS AND RADIOTOXINS ON CELLS OF EHRLICH ASCITES CARCINOMA

V. G. Kondratenko et al *In its* Radiobiology, Vol. 8, No. 3 1968 p 112–121 refs (See N69-30701 17-04)

Avail: CFSTI

A comparative investigation was made of the effects of γ-rays and quinoid radiotoxins on Ehrlich cancer cells. Using a cytofluorimetric method, it was shown that in the development of radiation damage to cellular nuclei, there is an almost complete analogy both under the action of ionizing radiation and under the action of radiotoxins. It was established that there is a dose and time dependence, and in the case of the action of radiotoxins a concentration dependence as well, in the development of radiation reactions in the DNA–protein complex of the nuclei. It is noted that the effects of radiation anabolites upon cellular nuclei begin to be manifested practically simultaneously with the effects of radiation. It is concluded that in the development of radiation effects, the role of a starter mechanism is played by the action of the ionizing rays, and an important role is played by the effects of radiation anabolites. Author

N69-30715# Joint Publications Research Service, Washington, D.C.

ELECTROLYTE COMPOSITION OF THE BLOOD PLASMA AND LIQUOR IN RABBITS IRRADIATED AFTER PROPHYLACTIC ADMINISTRATION OF CYSTAMINE

A. G. Kuzovkov et al *In its* Radiobiology, Vol. 8, No. 3 1968 p 122–127 refs (See N69-30701 17-04)

Avail: CFSTI

The content of sodium, potassium, and calcium ions in the spinomedullar fluid and in the blood plasma taken from the carotid artery and medullar venous sinus was studied in experiments on rabbits by the method of flame photometry. The indices of the calcium content reflect the total value of ionized and bound calcium. Irradiation of the animals is accompanied by pronounced hypokaliemia and a slightly increased sodium level. Cystamine administered before irradiation normalizes the potassium metabolism in the animal organism after irradiation and somewhat increases the sodium and calcium ion content in the blood in this case. Author

N69-30716# Joint Publications Research Services, Washington, D.C.

RELATIONSHIP BETWEEN THE FLUORINE AND CALCIUM CONTENTS IN THE DIET AND THE RESISTANCE OF ANIMALS TO THE INFLUENCE OF GAMMA-IRRADIATION

V. A. Knizhnikov et al *In its* Radiobiology, Vol. 8, No. 3 1968 p 128–134 refs (See N69-30709 17-04)

Avail: CFSTI

The significance of the level of intake of calcium and the trace element fluorine with the diet for the radioresistance of animals to single and fractionated whole-body γ-irradiation was studied in chronic experiments on 312 noninbred white rats. It was established that a diet enriched in calcium and fluorine substantially increases the radioresistance of the animals. Author

N69-30717# Joint Publications Research Service, Washington, D.C.

EXPERIMENTAL STUDY OF THE EFFECTIVENESS OF CYSTAMINE IN THE CASE OF PROLONGED INFLUENCE OF GAMMA-RAYS ON RATS

D. I. Zalyakova In Its Radiobiology, Vol. 8, No. 3 1968 p 135–139 refs (See N69-30701 17-04)

Avail: CFSTI

The effectiveness of the radioprotective action of cystamine and that of cystamine with amygdalin in various doses and courses of administration in the case of prolonged external γ-irradiation at a dose rate of 16.7 r/hour up to a total dose of 2000 r was studied on an experiment on 140 rats. The indicated dose produces 80–100 percent death of the animals within a 30-day period. It was established that the administration of the preparations before the beginning of irradiation and repeated administration during irradiation at a daily dose of 150mg/kg are ineffective. Repeated administration of the preparations in a daily dose of 450 mg/kg has a pronounced toxic effect. The causes of the absence of effectiveness of cystamine under conditions of the irradiation model studied are discussed. Author

N69-30718# Joint Publications Research Services, Washington, D.C.

RESTORATION OF RADIATION DAMAGES TO COTTON SEEDS DURING PROLONGED STORAGE

N. M. Berezina et al *In its* Radiobiology, Vol. 8, no. 3 1968 p 140-145 (See N69-30701 17-04) refs

Avail: CFSTI

It was established that cotton seeds irradiated at a lethal dose of 40 kr show a restoration of the viability lost under the influence of irradiation when they are stored for prolonged periods under laboratory conditions. All the seeds freshly irradiated at this dose die in the stage of the cotyledon leaves. Seeds stored for 8 and 12 months after irradiation develop true leaves, buds, and bloom. The restoration of viability is paralleled by a restoration of a whole series of physiological and biochemical disorders, arising in the freshly irradiated seeds: the chlorophyll content is restored, as is the activity of oxidative enzymes, and the content of radiotoxins is reduced. During prolonged storage of irradiated cotton seeds, a decrease in the radiation damages arising during irradiation of air-dried seeds at a dose of 40 kr is observed. Author

N69-30719# Joint Publications Research Service, Washington, D.C.

JOINT ACTION OF GAMMA-IRRADIATION AND THERMAL SHOCKS ON ARABIDOPSIS THALIANA (L) HEYNH. SEEDS

Ch. V. Nikolov et al *In its* Radiobiology, Vol. 8, No. 3 1968 p 146–153 refs (See N69-3070 17-04)

Avail: CFSTI

Air-dried seeds were subjected to γ-irradiation at doses of 40, 80, 120, and 160 kr, as well as to a temperature influence of 100°C for 30 minutes. Thermal shocks were applied before, after, or before and after irradiation. In the control and experimental groups of plants, death of the plants in the phases of the cotyledons and rosette, growth of the root and stem, the rate of passage through the basic phases of development, and fertility were studied. Postradiation thermal shocks intensified the effects of irradiation, while preradiation and double shocks weakened them. The possible mechanisms of the influence of thermal shocks upon the radiobiological responses of seeds are discussed. Author

N69-30720# Joint Publications Research Service, Washington, D.C.

INFLUENCE OF TRACE ELEMENTS ON THE SENSITIVITY OF SEEDS TO FAST FISSION NEUTRONS

G. V. Ponomarev *In its* Radiobiology, Vol. 8, No. 3 1968 p 154–160 refs (See N69-30701 17-04)

Avail: CFSTI

Within the range of fast fission neutron tissue doses up to 600 rad, no changes could be established in the radiosensitivity of barley seeds preliminarily germinated on a medium with an increased amount of boron. Preliminary germination on a medium with an increased amount of zinc increases the resistance of the

seeds to fast fission neutrons. Preliminary germination against a background of polyvalent cations (Fe, Mn, Co) increased the sensitivity of the seeds to fast fission neutrons. A relationship was noted between the increase in the radio sensitivity of the seeds and the maximum valence of the metal ions. Author

N69-30721# Joint Publications Research Service, Washington, D.C.

USE OF THE "STEBEL" GAMMA-APPARATUS IN EXPERIMENTAL RADIOBIOLOGY

G. T. Ratner et al *In its* Radiobiology, Vol. 8, No. 3 1968 p 161–166 refs (See N69-30701 17-04)

Avail: CFSTI

A dosimetric investigation was made of the dose distribution within the working chamber of the Stebel apparatus with a radioactive charge of ^{137}Cs, which broadens the possibility of utilizing it in radiobiological experiments where it is necessary to know the exact dose distribution over the volume being irradiated. The dose distribution was measured in air and a tissue equivalent phantom by chemical dosimetry. The dose rate in the center of the chamber can be varied from 750 to 100 rad/minute with the aid of inserted lead shields. By considering the parameters studied, good reproducible conditions of irradiation and accuracy of dosimetry can be ensured. Author

N69-30914# Oregon State Univ., Corvallis. Radiation Center.

STUDIES ON ENVIRONMENTAL POLLUTION BY MISSILE PROPELLANTS Final Report, May 1964–Jun. 1967

Frank N. Dost, D. J. Reed, and C. H. Wang Wright-Patterson AFB, Ohio AMRL Feb. 1969 39 p refs

(Contract AF 33(615)-1767)

(AD-686459; AMRL-TR-68-85) Avail: CFSTI CSCL 6/20

The effects of single experimental exposures of plants, fish and microorganisms to members of a group of inorganic fluoride oxidizing agents have been summarized. The information obtained has enabled estimation of the damage to be expected as a result of single accidental exposures in the field. These agents--nitrogen trifluoride (NF3), tetrafluorohydrazine (N2F4), oxygen difluoride (OF2), chlorine trifluoride (ClF3), bromine pentafluoride (BrF5), and chlorine pentafluoride (ClF5)--vary in chemical behavior and biological effects. NF3 is relatively innocuous; OF2 must be avoided absolutely by animals and plants, and both are quite stable chemically. The interhalogens react readily in contact with environmental constituents, and while destructive at the site of initial contact, they are self limiting in effect. N2F4 also reacts easily, but should cause only moderate damage. Plant injury in all cases would probably be limited to the currently growing crop, with little possibility of carry-over effects in soil. Author (TAB)

N69-30940# Aerojet-General Corp., Los Angeles, Calif. Space Div.

ELECTRICAL COUPLING AND NORMAL MODES OF OSCILLATION IN DENSE EXCITABLE CELLULAR STRUCTURES Final Report

Charles E. Hendrix Mar. 1969 19 p refs

(Contract N00014-67-C-0361)

(AD-684886; AGC/SD-9082/FR) Avail: CFSTI CSCL 6/4

The study of monostable electrochemical systems, of which the best known example is the iron-nitric acid interface, has led to the concept of distributed cellular systems in which the individual cells can be in either an active or a passive state, and can influence the state of neighboring cells. Such systems show promise for the synthesis of a new class of information-processing machines, characterized by ease of manufacture, high packing density and plasticity of internal structure. They are also of considerable utility as physical models of living brain tissue. Complex electrochemical systems and living neural tissue can both sustain oscillatory activity. In living systems, such oscillations are often associated with pathological conditions: e.g. epilepsy, heart fibrillation. The present studies have experimentally demonstrated controlled electrochemical oscillations of two types: cyclic reverberation in a closed loop, and epileptiform discharge in a sheet of simulated cortex. The conditions of onset and maintenance of such discharges have been determined and are well understood; it is now possible to design electrochemical oscillators or oscillation suppression systems as required, within limitations. In addition, a scaling law (analogous to those used in hydrodynamic model testing) was developed to permit the quantitative study of current distributions in morphologically complex cellular structures. Such structures may be constructed using bulk electrochemical techniques. Author (TAB)

N69-30970# Oesterreichische Studiengesellschaft fuer Atomenergie G.M.B.H., Siebersdorf. Institut fuer Biologie.

THE PROTEIN SYNTHESIS DURING THE DEVELOPMENT CYCLE OF THE SINGLE-CELL GREEN ALGA CHLORELLA PYRENOIDOSA [DIE PROTEINSYNTHESE IM VERLAUF DES ENTWICKLUNGSZYKLUS DER EINZELLIGEN GRUENALGE CHLORELLA PYRENOIDOSA]

H. Altman, F. Fetter, E. Cabella, and A. v. Szilvinyi Mar. 1969 11 p refs In AUSTRIAN

(SGAE-BL-31/1969) Avail: CFSTI

The protein content and the differences in the protein composition in synchronous cells of *Chlorella pyrenoidosa* were examined. The experimental method entailed determination of the total nitrogen and dry substances of the chlorella during a development cycle and separation of the soluble proteins by means of the disc electrophoresis of polyacrylamide. It was noted that the maximum synthesis of the soluble proteins coincides with the commencement of the development cycle and continues up to the seventh hour. The composition of the proteins was found to be subject to great fluctuations during the progression of the cycle. Transl. by K.W.

N69-30986*# Naval Aerospace Medical Inst., Pensacola, Fla.

EVALUATION OF OTOLITH ORGAN FUNCTION BY MEANS OF OCULAR COUNTERROLLING MEASUREMENTS

Earl F. Miller, II 20 Mar. 1969 17 p refs

(NASA Order R-93; NASA Order W-12398)

(NASA-CR-103256; NAMI-1063) Avail: CFSTI CSCL 06P

Measurements of ocular counterrolling by the photographic method provide specific and valid otolith function information. The precision of the test method has extended the usefulness of ocular counterrolling as an indicator of otolith function of individuals with severe macular destruction as well as normals subjected to conditions which act physiologically to deafferent these organs such as near weightlessness of aerospace flight. Author

N69-31027# Army Chemical Center, Edgewood, Md. Medical Research Lab.

OXIDATIVE INJURY TO HUMAN RED CELLS BY COPPER SULFATE Technical Report, Jun. 1967–Jun. 1968

Earl N. Metz Feb. 1969 19 p refs

(AD-684911; EATR-4254) Avail: CFSTI CSCL 6/20

In vitro experiments suggest that prolonged exposure of red cells to high concentrations of copper sulfate produces red cell injury analogous to that which occurs when cells deficient in glucose-6-phosphate dehydrogenase (G6PD) are exposed to oxidant compounds. By enzyme inhibition and acceleration of auto-oxidation, cupric ion in excess limits the ability of the red cell to maintain normal amounts of reduced glutathione (GSH) and at the same time increases the oxidant stress in the cell by release of H_2O_2. By this means copper poisoning alone could lead to hemolysis but would be even more hazardous if it occurred in persons genetically deficient in G6PD, glutathione reductase, or glutathione peroxidase, or in persons receiving drugs capable of generating hydrogen peroxide. Author (TAB)

N69-31050# Federal Aviation Administration, Oklahoma City, Okla. Office of Aviation Medicine.

PHYSIOLOGICAL STUDIES ON AIR TANKER PILOTS FLYING FOREST FIRE RETARDANT MISSIONS

C. E. Melton, Marlene Wicks, J. T. Saldivar, Jr., Jack Morgan, and Florence P. Vance Oct. 1968 12 p refs

(AM-68-26)

Preflight and postflight studies were carried out on five air tanker pilots; in-flight studies were carried out on four of these five pilots. Pre- and postflight studies consisted of a questionnaire and determinations of blood pressure, psycho-motor performance and urine chemistry for stress metabolites. In-flight studies consisted of ECG, rectal temperature, cockpit temperature and voice transmissions, all continuously recorded on magnetic tape. None of the measurements indicated that a significant amount of stress was involved nor was fatigue evident. Heart rates correspond to those of sedentary workers, though doubling of heart rate occurred during two emergencies (hydraulic line failure). Heart rate followed a consistent pattern during flights with the minimums occurring en route to and from fires and maximums during retardant drops. Author

N69-31152# California Univ., Berkeley. Lawrence Radiation Lab.

PARTIAL NUCLEOTIDE SEQUENCES FOR THREE UNIQUE T-1 R-NASE FRAGMENTS OF TMV-RNA

David A. Lloyd (Ph. D. Thesis) Jan. 1969 176 p refs

(Contract W-7405-ENG-48)

(PB-182945; UCRL-18672) Avail: CFSTI CSCL 06A

Three fragments having chainlengths of 26, 26, and 70 nucleotides, have been isolated from T-1 ribonuclease digests of TMV-RNA. These fragments appear to be unique in the TMA-RNA molecule. None of the three fragments can be a portion of the gene which codes for the TMV coat protein. Attempts to gain further information about the sequences of these fragments are also discussed. In this connection, a possible C-specific nuclease first reported by Anderson and Carter was investigated. USGRDR

N69-31203# Tracor, Inc., Austin, Tex.

ON STUDIES OF BINAURAL INTERACTION Summary Report

Bruce H. Deatherage and Thomas R. Evans Mar. 1969 36 p refs

(Contract Nonr-4193(00))

(AD-684829; TRACOR-69-358-U) Avail: CFSTI CSCL 6/16

The study sought to examine the temporal relations of binaural masking as compared with monaural masking for conditions of forward, simultaneous, and backward masking. Five aural conditions of different signal-masker configurations and a number of temporal relations were examined to determine the masking effects of a tone by a tonal masker. A discussion of the various contralateral masking conditions is presented. Author (TAB)

N69-31266# Armed Forces Radiobiology Research Inst., Bethesda, Md.

A MINIATURE TISSUE-EQUIVALENT IONIZATION CHAMBER FOR PULSE DOSIMETRY

C. S. Kurityzky, F. R. Shonka, H. O. Wyckoff, and W. F. Pfeiffer Nov. 1968 18 p refs

(AD-684824; AFRRI-TN68-9) Avail: CFSTI CSCL 6/18

For radiobiological purposes it is desirable to measure the absorbed dose in the material of interest with a high degree of accuracy and precision. In regions of large spatial variation it is important that the detector be as small as possible. To meet both requirements a miniature three-terminal tissue-equivalent ionization chamber was designed. It was produced by using injection molding and ultrasonic welding techniques. The chamber has an outside diameter of 5.5 mm and an ionizing volume of approximately 0.01 cu cm. The chamber was exposed to pulses from the AFRRI-TRIGA reactor to evaluate its collection efficiency and precision. For 100,000-rad pulses with peak dose rates of 10 million rads per second the collection efficiency was measured to be 85 percent. For 7000-rad pulses the collection efficiency was 98 percent. The precision of the chamber for fifteen-1000-rad pulses gave a standard deviation of 0.2 percent. Author (TAB)

N69-31318# Institute of Oncology, Warsaw (Poland).

RESEARCH WORK OF THE INSTITUTE FOR 1966 [RAPORT Z PRAC BADAWCZYCH PROWADZONYCH W 1966 ROKU] Annual Report

W. Jasinskiego 1967 148 p refs In POLISH

(NEIC-RR-26) Avail: AEC Depository Libraries

Progress is reported on research at the Institute of Oncology in Poland. Studies were conducted on the treatment of malignant tumors. Highest frequencies of carcinomas were found to be cervical cancer, cancer of the skin and lip, mammary cancer, cancer of the alimentary tract, and bronchial cancer. The influence of environmental factors on mortality rates was investigated. Research in experimental oncology included studies on cytogenetics, immunology, biochemistry, and histochemistry. Investigations were conducted on the pathology of stomach cancer with special attention to the relation between structure and clinical progression of the disease. Other studies were conducted on clinical chemistry, improvements in γ and x ray therapy techniques, and clinical applications of radioisotopes. NSA

N69-31323# Joint Publications Research Service, Washington, D.C.

DOLPHIN DERMAL RIDGES, BODY STREAMLINING STUDIED

V. Ye. Sokolov et al 8 Jul. 1969 7 p refs Transl. into ENGLISH from Byul. Mosk. Obshchestva Ispytatelei Prirody, Otd. Biol. (Moscow), no. 3 1968 p 123-126

(JPRS-48363) Avail: CFSTI

The placement of dermal ridges, and their papillae on the body of cetaceans is studied in three different species of dolphins. It is hypothesized that the orientation of the dermal ridges is caused by the requirement that the integument resist the stream of water, when the animal is swimming, to effect laminar flow. An analysis of the distinct dermal ridge patterns for each species is presented. F.O.S.

N69-31356*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

COORDINATION OF THE VOLUNTARY MOVEMENTS OF MAN IN A ZERO GRAVITATIONAL FIELD (UNDER WEIGHTLESSNESS) [KOORDINATSIYA PROIZVOL'NYKH DVIZHENIY CHELOVEKA V NULEVOM GRAVITATSIONNOM POLE (V NEVESOMOSTI)]

L. V. Chkhaidze Washington NASA Jul. 1969 34 p Transl. into ENGLISH of the book "Koordinatsiya Proizvol'nykh Dvizheniy Cheloveka v Usloviyakh Kosmicheskogo Poleta" Moscow, Nauka Press, 2d. ed., 1966

(Contract NASw-1692)

(NASA-TT-F-578) Avail: CFSTI CSCL 06S

The coordination of the voluntary movements of man in a zero gravitational field (weightlessness) is analyzed on the base of observational data accumulated under conditions of temporary weightlessness and in flights of artificial manned satellites. The general biomechanical rules of movements performed under weightlessness conditions are derived from tests carried out according to cyclographic method. The discussions regarding coordination during weightlessness are supplemented by the personal reports of Soviet cosmonauts, as well as the American astronaut John Glenn.

It is concluded that even prolonged weightlessness causes no serious or lasting disorders in an invividual's movement coordination if he has been properly and adequately trained. However, certain changes should be expected in the dimensionality of the dynamic components of the coordination structure of skills performed in an altered gravitational field, and the limits to the decrease of the elements of the movement structure can reach 50%. Author

N69-31389*# IIT Research Inst., Chicago, Ill.
LIFE IN EXTRATERRESTRIAL ENVIRONMENTS Final Report, 16 Feb. 1968–14 Jul. 1969
Charles A. Hagen 15 Jul. 1969 24 p refs
(Contract NASr-22)
(NASA-CR-103319; IITRI-L6023-18) Avail: CFSTI CSCL 06C

A chamber was constructed to simulate Martian dust storms and to study the survival of airborne microorganisms exposed to a simulated Martian environment that included ultraviolet irradiation and daily freeze–thaw temperatures. The percent survivors of organisms exposed to ultraviolet radiation were equal to or greater than the nonirradiated organisms, suggesting that some factors, probably the soil particles, protected the organisms from ultraviolet irradiation. Salt tolerant, facultative anaerobes were isolated from desert, tundra, and temperate climate soils. All of the salt tolerant isolates, which included *Bacillus* and *Coccus* species, survived in a simulated Martian environment. The organisms that grew in the simulated Martian environment were chiefly isolates from desert and tundra soils, which implied that growth was more related to the native environment of the organism. Author

N69-31401*# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE OXYGEN REGIME OF THE ORGANISM AND ITS REGULATION (SYMPOSIUM)
N. V. Lauer ed. and A. Z. Kolchinskaya ed. 1969 372 p refs
Transl. into ENGLISH of the book "Kislorodnyi Rezhim Organizma I Ego Regulirovanie (Materialy Simpoziuma)" Kiev, Naukova Dumka, 1966 Published for NASA and NSF *Its* IPST Cat. No. 5275
(NASA-TT-F-501; TT68-50302) Copyright. Avail: CFSTI CSCL 06P

Presented are various studies of respiration and its regulation. Evaluated are the effects of breathing, circulation, and oxygen metabolism in the organism and the role of oxygen parameters in the regulation of autonomic functions governing the gas exchange. For individual titles, see N69-31401 through N69-31444.

N69-31402*# Israel Program for Scientific Translations, Ltd., Jerusalem.
RESPIRATION AND THE ORGANISM OF THE BODY [O KISLORODNOM REZHIME ORGANIZMA]
N. V. Lauer et al *In its* The Oxygen Regime of the Organism and its Regulation (Symp.) 1969 p 1–13 (See N69-31401 17-04)
Copyright. Avail: CFSTI CSCL 06P

Reviewed are the various contributions to the theory of reflex and humoral control of respiration and circulation in the human body. Discussed are the fine anatomical and functional interrelationships between the central and peripheral nervous structures participating in the control of these physiological functions, as well as data concerning the effects of chemical agents, including oxygen and carbon dioxide, upon the central and peripheral nervous structures. The high degree of coordination of the activity of the various systems suggests the presence in the body of a single system controlling the uptake of oxygen by lungs, alveoli, and blood, oxygen transport by arterial blood, oxygen supply in accordance with the body's energy requirements, and elimination of metabolic carbon dioxide. Several possibilities for the transmission and control of oxygen supplies to the various body systems are depicted and possible mathematical control models are derived. G.G.

N69-31403*# Israel Program for Scientific Translations, Ltd., Jerusalem.
CALCULATION OF RESPIRATORY INDEXES AND CONSTRUCTION OF OVERALL OXYGEN GRADIENTS [RASCHETY PARAMETROV KISLORODNYKH REZHIMOV ORGANIZMA I POSTROENIE KISLORODNYKH KASKADOV]
N. V. Lauer et al *In its* The Oxygen Regime of the Organism and its Regulation (Symp.) 1969 p 14–18 (See N69-31401 17-04)
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Outlined are physicochemical and biochemical processes of the body's oxygen regime that maintain equilibrium between the requirements of the tissues for oxygen and its supply. Emphasis is placed on oxygen partial pressure gradients maintained at different stages of its progress through the body and the relationships between the demands of the tissues for oxygen and its supply. The respiratory control center coordinates this variety of mechanisms in order to maintain oxygen parameters at optimal level over the entire path of oxygen through the body. The rate of oxygen consumption in tissues depends on their conditions, on neurohormonal control over processes occurring at tissue, cellular, and molecular levels, and on the oxygen parameters of arterial and venous blood. Respiratory efficiency is subject to oxygen quantity utilized, oxygen pressure levels and gradients at each stage of the respiratory control center, and the relationship between the work done at each functional system and the quantity of oxygen consumed by the body. These indexes represent the economy of the overall oxygen regime in its separate stages and of the roles played by breathing, circulation, and red blood corpuscles in controlling the respiratory system. G.G.

N69-31404*# Israel Program for Scientific Translations, Ltd., Jerusalem.
TRANSIENT PROCESSES AT THE FIRST STAGE OF THE BODY'S RESPIRATORY CONTROL SYSTEM [K VOPROSU O PEREKHODNYKH PROTSESSAKH V PERVOM ZVENE SISTEMY REGULIROVANIYA KISLORODNYKH REZHIMOV ORGANIZMA]
E. A. Shkabara *In its* The Oxygen Regime of the Organism and its Regulation (Symp.) 1969 p 19–22 (See N69-31401 17-04)
Copyright. Avail: CFSTI CSCL 06P

A mathematical description is developed for the transient processes at the first stage of the body's respiratory control system. The oxygen content of the external air entering the pulmonary reservoir is determined by partial pressure and the volume of air entering the lungs per minute and the oxygen content of the alveolar air at the output of the first stage is represented in parameters. The mathematical relationship between the input and the output and the static characteristics of oxygen content in alveolar air as a function of its content are described by linear equations. Variations in respiratory rate and volumes then transfer the linear differential equation into a nonlinear one where the time and gain coefficients become variables dependent upon the time variation of oxygen content in alveolar air. G.G.

N69-31405*# Israel Program for Scientific Translations, Ltd., Jerusalem.
ASSESSMENTS OF ACCURACY IN CALCULATIONS OF RESPIRATORY INDEXES [OTSENKI TOCHNOSTI RASCHETOV PARAMETROV KISLORODNOGO REZHIMA ORGANIZMA]
N. A. Kulikov *In its* The Oxygen Regime of the Organism and its Regulation (Symp.) 1969 p 23–39 refs (See N69-31401 17-04)
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Maximum errors in respiratory indexes were calculated by considering the following: (1) normal error distribution due to time variation of the measured quantity; (2) equal accuracy degree for all measurements; (3) independence and uniform distribution of

measurement error for single measurements; and (4) mutual independence of both total error components. The total error component was diminished by increasing the number of determinations. The maximum relative error for gas concentration measurements in air depended upon the determined quantity and the number of consecutive observations necessary to keep the total relative error within 5%. G.G.

N69-31406*# Israel Program for Scientific Translations, Ltd., Jerusalem.
AN AUTOMATIC MODEL OF THE RESPIRATORY CONTROL SYSTEM [AVTOMATICHESKAYA MODEL' SISTEMY REGULIROVANIYA KISLORODNOGO REZHIMA ORGANIZMA]
A. N. Medelyanovskii et al *In its* The Oxygen Regime of the Organism and its Regulation (Symp.) 1969 p 40–49 (See N69-31401 17-04)
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Cybernetic application of the feedback principle, utilizing deviations of an internal environment index for controlling the correction of this deviation, is proposed for an automatic maintenance system model of respiratory control. A complex network of feedback connections, in which combinations of receptor and effector elements constitute intertwining control circuits of various physiological parameters, is presented graphically. The system uses the following types of feedback for gas-jet phase shifts: (1) feedback for regulating internal environment parameters; (2) feedback for stepwise switching of body systems in connection with deviations of controlled parameters; (3) feedback connections for the optimization of preset parameter levels; and (4) effector-to-receptor feedbacks to eliminate control inconsistencies. G.G.

N69-31407*# Israel Program for Scientific Translations, Ltd., Jerusalem.
A MATHEMATICAL APPROACH TO THE INVESTIGATION OF ENERGY CONSUMPTION BY ACTIVE HUMAN BEINGS IN ENCLOSED SPACES [MATEMATICHESKII PODKHOD K IZUCHENIYU DINAMIKI ENERGOTRAT CHELOVEKA V ZAMKNUTOM OBEME]
V. K. Vasilev et al *In its* The Oxygen Regime of the Organism and its Regulation (Symp.) 1969 p 50–53 (See N69-31401 17-04)
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Developed is a theoretical model for continuous determination of human gas exchange dynamics in enclosed chambers. Correlation between the variable human gas exchange parameters and the stabilized physical environment involves the determination of gas exchange equations. Linear control theory is used to express this relationship through convolutional integrals. Example calculations analyze the oxygen consumption dynamics of a man in a flow type airtight environmental chamber. G.G.

N69-31408*# Israel Program for Scientific Translations, Ltd., Jerusalem.
AN ANALYSIS OF RESPIRATORY TRANSFORMATION MECHANISMS OCCURING DURING FETAL GROWTH [K ANALIZU NEKOTORYKH MEKHANIZMOV PREOBRAZOVANIYA KISLORODNOGO REZHIMA V PROTSESSE ONTOGENEZA]
I. A. Arshavskii *In its* The Oxygen Regime of the Organism and its Regulation (Symp.) 1969 p 54–63 (See N69-31401 17-04)
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Long term effects of maternal oxygen deficiency upon the growth and development of rabbit fetuses were studied. Pregnant rabbits were exposed daily for 2 hours to a rarefied altitude. Towards the end of pregnancy exposed fetuses reached a weight of 80 to 94g instead of the normal 35 to 50g. High respiratory intensity observed at the early age coexisted with adrenergatic features of homeostasis. The relative size of oxygen systems in the newborne larger animals of nearly double normal weight was attributed to strain effects on the respiratory and cardiovascular systems due to maternal hypoxemia. G.G.

N69-31409*# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE ROLE OF BREATHING IN RESPIRATORY CONTROL [O ROLI VNESHNEGO DYKHANIYA V REGULIROVANII KISLORODNOGO REZHIMA ORGANIZMA]
M. M. Seredenko *In its* The Oxygen Regime of the Organism and its Regulation (Symp.) 1969 p 64–69 (See N69-31401 17-04)
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Described are experimental hypoxia and aging models that assess the role of breathing in respiratory control during a lifetime. The largest quantity of oxygen entering the alveoli per minute occurs in middle aged subjects and efficiency indexes of that group indicate the highest levels. This efficiency is somewhat lower in young adults and still lower in children and elderly subjects. G.G.

N69-31410*# Israel Program for Scientific Translations, Ltd., Jerusalem.
ARTERIAL, VENOUS, AND TISSUE RECEPTORS AND THE CONTROL OF BREATHING DURING HYPOXIA [O8 UCHASTII ARTERIALNYKH, VENOZNYKHI I TKANEVYKH RETSEPTOROV V REGULYATSII VNESHNEGO DYKHANIYA PRI GIPOKSII]
L. I. Ardashnikova *In its* The Oxygen Regime of the Organism and its Regulation (Symp.) 1969 p 70–74 (See N69-31401 17-04)
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Chemoreceptors of the cardioaortic and sinocarotid regions were stimulated by the partial oxygen pressure of the arterial blood; respiration was only affected at low oxygen pressures. Intensified respiration during prolonged hypoxia was not related to chemoreceptor stimulation. It was concluded that the role of pulmonary arterial receptors in external respiration control is not clearly understood. In the case of hypoxic hypoxia, the primary phenomenon was the decrease of partial oxygen pressure in arterial and venous blood. However, after denervation of the carotid and cardioaortic zones, respiration did not intensify after abrupt oxygen pressure reduction in the inspired air. G.G.

N69-31411*# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE REACTIONS OF BREATHING AND MYOCARDIAL TISSUE TO HYPOXEMIC TEST CONDITIONS [REAKTSIYA VNESHNEGO DYKHANIYA I MIOKARDA NA GIPOKSEMICHESKUYU PROBU]
A. G. Dembo et al *In its* The Oxygen Regime of the Organism and its Regulation (Symp.) 1969 p 75–79 (See N69-31401 17-04)
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Reactions of breathing and myocardial tissue to reduced oxygenation of arterial blood were studied on 102 young, highly qualified and experienced athletes and, for comparison, on 17 healthy nonathletes. The oxygenation of arterial blood was artificially reduced in the following four ways: (1) by inhibition of respiration; (2) by reverse respiration; (3) by inspiration of mixtures containing 10.3%–10.5% oxygen; and (4) by inspiration of 14%–15% oxygen mixtures. In all cases the concentration of carbon dioxide under the bell jar at the end of the experiment did not exceed 0.2%–0.3%, due to lime absorption. Arterial oxygenation was determined with an oxyhemograph. Saturation was held above 65%–70% to avoid possible significant alteration in the central

nervous system. Studies were also made of the reactions of breathing, viz., absorption of oxygen per min, respiration depth and rate, respiratory minute volume (RMV), and the coefficient of oxygen utilization, with both the ECG and vector-cardiogram. It was found that the duration of reverse respiration, breath holding, and respiration of gaseous mixtures with low oxygen concentration do not, in themselves, determine the degree of arterial hypoxaemia, since the time of occurrence of arterial hypoxaemia is an individual trait. Author

N69-31412*# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE ROLE OF THE CHEMORECEPTORS OF THE CAROTID BODIES IN PULMONARY RESPIRATION CONTROL [O ROLI KHEMORETSEPTOROV KAROTIDNYKH KLUBOCHKOV V REGULYATSII LEGOCHNOGO DYKHANIYA]

S. S. Krylov *In its* The Oxygen Regime of the Organism and its Regulation (Symp.) 1969 p 80–82 (See N69-31401 17-04)

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Among the body's interoceptor devices are the chemoreceptors of the carotid reflexogenic zone located in the carotid bodies which stimulate the respiration. When the carotid bodies are disconnected by removing a section of the sinus nerve or by extirpation of the carotid body, an untrained subject cannot react to hypoxia by stimulation of the pulmonary respiration and the hypoxia inhibits the subject's general condition. Characteristic of the hypoxic stimulation of carotid chemoreceptors is its marked inertia. It is concluded that hypoxic stimulation of the carotid bodies provides specialized information to the central nervous system concerning decreased oxygen tension in the blood. G.G.

N69-31413*# Israel Program for Scientific Translations, Ltd., Jerusalem.

OXYGEN REQUIREMENTS AND CIRCULATION [KISLORODNYI ZAPROS I KROVOOBRASHCHENIE]

L. L. Shik *In its* The Oxygen Regime of the Organism and its Regulation (Symp.) 1969 p 83–87 (See N69-31401 17-04)

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Discussed is the relationship between oxygen requirement and circulation controls which maintains the constant level of arterial pressure and effects the vascular peripheral resistance in every organ, primarily in accordance with its own oxygen requirements. Since levels of arterial pressures are related to local control of the blood flow in different organs, a central circulation control is ruled out. Pulmonary minute volume circulation in patients with ductus arteriosis, defective septum atriorum, or septum ventriculorum cordis doubled and often trebled the normal quantity. Circulatory minute volume is maintained even in severe aortic stenosis, despite very pronounced pressure changes in the cardiac cavities. G.G.

N69-31414*# Israel Program for Scientific Translations, Ltd., Jerusalem.

AGE-CONDITIONED CHANGES IN BLOOD CIRCULATION AND RESPIRATORY CONTROL [O ZNACHENII VOZRASTNYKH IZMENENII GEMODINAMIKI V REGULIROVANII KISLORODNOGO REZHIMA ORGANIZMA]

M. M. Koganovskaya *In its* The Oxygen Regime of the Organism and its Regulation (Symp.) 1969 p 88–94 (See N69-31401 17-04)

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The quantity of oxygen supplied to the tissues by the bloodstream per unit time depends, in the main, upon the circulatory minute volume. A comparison was made of the oxygen reserves of circulatory minute volumes in animals of different age groups. In normal puppies aged 2–3 weeks, the quantity of oxygen delivered by arterial blood per kg body weight per min is larger than in animals. This is so despite the comparatively small oxygen capacity of the blood and the comparatively low oxygen concentration in the arterial blood. The same was found for puppies at the age of puberty. On the other hand, the quantity of oxygen delivered to the tissues by arterial blood per min in old dogs is considerably smaller than it is in middle-aged dogs. This results from the comparatively small circulation volume of old dogs. Author

N69-31415*# Israel Program for Scientific Translations, Ltd., Jerusalem.

CHANGES IN THE BLOOD CIRCULATION DURING RESPIRATORY VARIATIONS AND REGIONAL CIRCULATION [GEMODINAMICHESKIE SDVIGI I REGIONARNOE KROVOOBRASHCHENIE PRI IZMENENIYAKH KISLORODNOGO REZHIMA ORGANIZMA]

N. I. Gurevich et al *In its* The Oxygen Regime of the Organism and its Regulation (Symp.) 1969 p 95–101 (See N69-31401 17-04)

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The processes of circulation control during hypoxic states were studied on cats. After breathing a gaseous mixture containing 9.6% oxygen for 5 to 10 minutes, the circulatory minute volume of the cats was reduced; their arterial pressure remained slightly elevated for some time due to increased general peripheral vascular resistance. In hypoxic hypoxia different tissues differed with respect to oxygen supply; oxygen tension decreased in the skeletal muscles and the skin steadily whereas the cerebral cortex oxygen tension remained at a fairly constant level after an initial slight decrease. The optimal blood oxygen supply to the most important organs during hypoxia involved a redistribution of blood throughout the body. G.G.

N69-31416*# Israel Program for Scientific Translations, Ltd., Jerusalem.

OXYGEN RESERVES IN ANIMALS AND MAN [PROBLEMA REZERVOV KISLORODA V ORGANIZME ZHIVOTNYKH I CHELOVEKA]

P. A. Korzhuev *In its* The Oxygen Regime of the Organism and its Regulation (Symp.) 1969 p 102–106 (See N69-31401 17-04)

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A comparison of oxygen consumption intensity by cells and tissues of man and different animals revealed that consumption per unit mass was the same in all animals, irrespective of their phylogenetic position; these levels rose only in homoiothermic animals, but were also constant in all homiotherms. The greater increase of oxygen supply capacity in terrestrial vertebrates was related to their aeration organs which together with larger oxygen delivery mechanisms produced larger quantities of blood and hemoglobin. G.G.

N69-31417*# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE CONTROL OF OXYGEN RELEASE BY THE ERYTHROCYTES [O REGULIROVANII OTDACHI KISLORODA ERITROTSITAMI]

F. I. Gimmenikh *In its* The Oxygen Regime of the Organism and its Regulation (Symp.) 1969 p 107–112 (See N69-31401 17-04)

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Formulated is a working hypothesis according to which glycolysis in erythrocytes intensifies the effects of differences in partial pressures of blood oxygen transport. Addition of erythrocytes washed free of glucose to unwashed erythrocytes markedly increased oxygen release; this reaction is not effective when glycolysis was prevented by sodium fluoride or by hemolysis of the erythrocytes. Experiments at different pH values clearly demonstrate

that erythrocytic oxygen release during glycolysis is intensified by an increase in the pH of the blood plasma. Observations on human subjects and rabbits also demonstrate that the energy of hemoglycolysis increased by injections of insulin and diminished by injections of adrenaline. It is concluded that the endocrine system is the controlling factor in oxygen release by erythrocytes. G.G.

N69-31418*# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE ERYTHROCYTIC SYSTEM AND RESPIRATORY CONTROL [O ROLI ERITROTSITARNOI SISTEMY V REGULVATSII KISLORODNOGO REZHIMA ORGANIZMA]
Yu. V. Semenov *In its* The Oxygen Regime of the Organism and its Regulation (Symp.) 1969 p 113–118 (See N69-31401 17-04)
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The erythrocytic system possesses the capacity for altering the oxygen-fixing function of circulating blood in accordance with oxygen requirements of the tissues. This function is limited by the magnitude of the surface area and the oxygen-fixing activity of the erythrocytes. The oxygen-fixing capacity thus depends on the degree of affinity of corpuscular hemoglobin for oxygen and the oxygen capacity of the red blood cells. Other mechanisms controlling the oxygen-fixing properties of the blood operate at cellular and molecular levels. Experimental data on the oxygen transporting function of the erythrocytic system and the blood circulation on hypoxic dogs demonstrate that during the development of acute hypoxia the mean hemoglobin content of an erythrocyte decreases, but the hemoglobin concentration remains unchanged. This suggests that the body possesses a mechanism for selective deposition of small erythrocytes. G.G.

N69-31419*# Israel Program for Scientific Translations, Ltd., Jerusalem.
MECHANISMS CONTROLLING THE RESPIRATORY SURFACE OF BLOOD IN CONNECTION WITH OXYGEN DEFICIENCY [NEKOTORYE MEKHANIZMY REGULYATSII DYKHATELNOI POVERKHNOSTI KROVI V SVYAZI S KISLORODNOI NEDOSTATOCHNOSTYU]
L. G. Gorozhanin *In its* The Oxygen Regime of the Organism and its Regulation (Symp.) 1969 p 119–124 (See N69-31401 17-04)
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Examined was the participation of chemoreceptors, the sinocarotid zone, and of the spleen in the mechanism of blood redistribution and erythropoiesis in hypoxic dogs. Observed were erythrocytosis, reticulocytosis without alteration of the differential count, and increased blood circulation volume with increased numbers of circulating erythrocytes. Dogs with denervated carotid sinuses responded to brief oxygen starvation similar to intact animals; however, after termination of acute hypoxia, restoration of peripheral blood parameters lagged 30 to 60 minutes behind that of intact dogs. Splenectomized dogs lacked the acute erythrocyte reaction to hypoxia and displayed disturbances in their hematopoietic reactions. The absence of erythrocytosis in splenectomized hypoxic animals is explained by the normal erythrocyte concentration in their spleens. G.G.

N69-31420*# Israel Program for Scientific Translations, Ltd., Jerusalem.
ADAPTIVE ALTERATIONS OF OXYGEN TRANSPORT IN CELL CYTOPLASMA AND MITOCHONDRIA [PRISPOSOBITELNYE IZMENENIYA TRANSPORTA KISLORODA V KLETOCHNOI TSITOPLAZME I MITOKHONDRIYAKH]
Z. I. Barboshova *In its* The Oxygen Regime of the Organism and its Regulation (Symp.) 1969 p 125–132 (See N69-31401 17-04)
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The principal motive force causing oxygen to pass from the capillary blood into the cell and its mitochondria is the difference in the partial pressures of molecular oxygen between the capillary, the cell, and the mitochondria. The quantity of transported oxygen does not depend solely upon the diffusion gradient at the blood/tissue interface but also upon the following factors: (1) the quantity of blood flowing through the tissues; (2) the rate of the blood flow through tissue capillaries; (3) the oxygen capacity of blood; (4) the oxygen-fixing properties of hemoglobin; (5) the activity of the enzyme globin oxidase; (6) the pH of blood and its concentration of CO_2; (7) the activity of certain blood enzymes; (8) the ambient temperature; and (9) the salt concentration. All the above conditions, as well as several other factors, cause release of 30%–35% of the oxygen held in the oxyhemoglobin under conditions of rest. Adaptive alterations of oxygen transport in tissues depend on enzymatic activities and myoglobin concentrations in the muscles which in turn are very much influenced by the sympathetic nervous system. Author

N69-31421*# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE THEORY OF OXYGEN DYNAMICS IN TISSUES [O TEORII DINAMIKI KISLORODA V TKANYAKH]
E. A. Kovalenko *In its* The Oxygen Regime of the Organism and its Regulation (Symp.) 1969 p 133–148 (See N69-31401 17-04)
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Reported are theoretical calculations and mathematical models of diffusion processes involved in oxygen delivery to living tissues. The path of oxygen penetration into the body is represented as a continuously descending gradient of the partial pressure of oxygen in the alveoli, in the arterial, capillary, and venous blood, and in the tissues. The diffusion forces depend upon the Brownian motion of molecules and are expressed in a theory of oxygen diffusion according to which the process is conditioned by the physical properties of the gas and the gradient of its partial pressures. Example calculations on oxygen diffusion in a tissue cylinder model as an oxygen delivery scheme, together with the oxygen-cerebral tissue hypothesis are used to evaluate experimental data of cerebral oxygenation of animals. G.G.

N69-31422*# Israel Program for Scientific Translations, Ltd., Jerusalem.
EFFECT OF OXYGEN-STARVATION ON THE METABOLISM OF PHOSPHOLIPIDS IN THE CEREBRUM [VLIYANIE KISLORODNOGO GOLODANIYA NA OBMEN FOSFOLIPIDOV V GOLOVNOM MOZGU]
S. V. Gasteva et al *In its* The Oxygen Regime of the Organism and its Regulation (Symp.) 1969 p 149–153 (See N69-31401 17-04)
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The effect of oxygen starvation on the metabolism of phospholipids in the central nervous system was studied by determining the metabolic changes and the inhibiting effect of hypoxia on metabolic processes in the CNS tissue. Albino rats of the Wistar strain were severly affected by hypoxia at barometric pressures of 180–140 mm Hg and showed a 40% lethality after 2 hrs. Total phospholipid and phospholipid fraction assessments on decapitated rats and metabolic activity assessments of the phosphate group of the phospholipids from the incorporation rate of radioactive orthophosphate showed a statistically significant ($P < 0.001$) specific radioactivity of the cerebral phospholipids; this specific radioactivity was dependent upon body temperature and independent of the rarefaction of the gases in the chamber ($P > 0.10$). It was concluded that variations in cerebral tissue metabolism and decreased phospholipid metabolic intensity were caused by several adaptive mechanisms which switched the functioning of these systems to different levels. G.G.

N69-31423*# Israel Program for Scientific Translations, Ltd., Jerusalem.

MECHANISMS OF THE REDOX PROCESS DISTURBANCE IN EXPERIMENTAL MYOCARDIAL INFRACTION [NEKOTORYE MEKHANIZMY NARUSHENIYA OKISLITELNOVOSSTANOVITELNYKH PROTSESSOV PRI EKSPERIMENTALNOM INFARKTE NIOKARDE]

B. M. Shargorodskii et al *In its* The Oxygen Regime of the Organism and its Regulation (Symp.) 1969 p 154–157 (See N69-31401 17-04)

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The dynamics of oxidation process disturbances in experimental myocardial infraction were studied through the redox potential of both the composite and the individual redox systems; the redox potential was determined from the concentration ratios of oxidized and reduced tissues in the heart. Data indicated that the following features caused disturbances in heart respiration during acute myocardial infraction: (1) different mechanisms responsible for lowering of the redox potential at different intervals, and (2) disturbances due to conditions preventing the manifestation of the catalytic enzyme properties. G.G.

N69-31424*# Israel Program for Scientific Translations, Ltd., Jerusalem.

AGE-CONDITIONED FEATURES OF OXIDATION PROCESSES IN THE HEART AND THEIR CONTROL [VOZRASTNYE OSOBENNOSTI OKISLITELNYKH PROTSESSOV V SERDTSE I IKH REGULYATSIYA]

V. V. Frolkis et al *In its* The Oxygen Regime of the Organism and its Regulation (Symp.) 1969 p 158–164 (See N69-31401 17-04)

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Analyzed is the significant decrease in the intensity of the endogenous myocardial respiration with advancing age by evaluating the possible mechanisms reducing the oxygen consumption in tissues: (1) the age conditioned decrease in the number of actively respiring cell elements; and (2) the age conditioned fundamental alterations in the different links of the oxidation processes, reducing the respiratory intensity. Since all processes of cell respiration and the liberation of energy are related to mitochondria it is assumed that a decrease in the number of mitochondria in the heart is one of the main causes of low cardiac tissue respiration. Animal studies also show that the activities of the various enzymatic processes in heart mitochondria undergo age conditioned changes. One of the important limiting factors of myocardial respiration in old age is the decrease in cytochrome oxidase activity and thus effects the electron chain transfer in biological tissue oxidation. G.G.

N69-31425*# Israel Program for Scientific Translations, Ltd., Jerusalem.

EFFECT OF THE RESPIRATORY PHOSPHORYLATION INHIBITOR 2,4-DINITROPHENOL UPON THE CONSUMPTION OF OXYGEN BY MUSCULAR TISSUE [VLIYANIE INGIBITORA DYKHATELNOGO FOSFORILIROVANIYA α, 2-4-DINITROFENOLA NA POTREBLENIE KISLORODA NYSHECHNOI TKANYU]

T. A. Popov et al *In its* The Oxygen Regime of the Organism and its Regulation (Symp.) 1969 p 185–187 (See N69-31401 17-04)

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Investigated was the compound 2,4-dinitrophenol (DNP) as an inhibitor of oxidation by phosphorylation on albino rats. The animals received either peroral administration of aqueous DNP solution with concentrations of 1/20 LD_{50} – 1.5 mg/kg for 90 days or the same dose at the day of experiment. The oxygen consumption rate was determined by means of oxygen load and respiration in muscular tissues was recorded by polariographic apparatus. An analysis of obtained data showed that a single administration of DNP caused a considerable decrease in the oxygen saturation of the muscles; the consumption of oxygen was increased. The first experimental group exhibited the cumulative effects of DNP. Thus, it was concluded that peroral administration of DNP increased the consumption of oxygen by muscular tissues. G.G.

N69-31426*# Israel Program for Scientific Translations, Ltd., Jerusalem.

CONTROL OF OXYGEN CONSUMPTION IN HEALTHY AND ILL PERSONS [K VOPROSU O REGULIROVANII POTREBLENIYA KISLORODA V ORGANIZME ZDOROVOGO I BOLNOGO CHELVEKA]

E. N. Domontovich et al *In its* The Oxygen Regime of the Organism and Its Regulation (Symp.) 1969 p 168–171 (See N69-31401 17-04)

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Breathing and ciculatory responses of healthy subjects and of patients suffering from tuberculosis were studied in order to determine their oxygen consumption. Results revealed a disruption of oxygen control in sick subjects. This malfunction was not only attributed to the state of the respiratory and circulatory systems, but also to that of the self-regulatory system controlling oxidation processes. G.G.

N69-31427*# Israel Program for Scientific Translations, Ltd., Jerusalem.

RESPIRATION OF THE BRAIN AT RAISED INTRACRANIAL PRESSURE [KISLORODNYI REZHIM MOZGA PRI POVYSHENNOM VNUTRICHEREPNOM DAVLENII]

E. A. Ilin *In its* The Oxygen Regime of the Organism and Its Regulation (Symp.) 1969 p 172–175 (See N69-31401 17-04)

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Studied was the respiration of the brain at different intracranial pressures in order to determine those pressures that give rise to cerebral hypoxia due to inadequate cerebral circulation. The intracranial pressure of rabbits was raised by pumping a physiological solution into the subdural space over the cerebral cortex or into the cerebellomedullary cistern. Brain respiration at raised intracranial pressure was studied by polarographic determinations of the partial oxygen pressure. Results showed that intracranial pressure of 270 mm water and above disturbed the cerebral respiration. Breathing of 100% oxygen at intracranial pressure up to 540 mm water effectively restored disturbed cerebral respiration. Mechanical irritation of the dura mater and irradiation and damage to the trigeminal ganglion and section of the root of the fifth cranial nerve caused a decrease in partial oxygen pressure in the cerebral cortex. G.G.

N69-31428*# Israel Program for Scientific Translations, Ltd., Jerusalem.

PHYSIOLOGICAL MECHANISMS OF CHANGES IN OXYGEN CONSUMPTION AND BODY TEMPERATURE IN HYPOXIA [FIZIOLOGICHESKIE MEKHANIZMY IZMENENII POTREBLENIYA KISLORODA I TEMPERATURY TELA PRI GIPOKSII]

K. P. Ivanov *In its* The Oxygen Regime of the Organism and Its Regulation (Symp.) 1969 p 176–180 (See N69-31401 17-04)

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The inhibition of controlled gas exchange in the form of chemical thermoregulation by hypoxia was studied by observing variations in shivering and thermoregulatory tone as well as variations in body temperature and gas exchange of different animals. In rates, decompression caused a decrease in the electrical activity of the muscles parallel with the decrease in body temperature. Preliminary

cooling of the animals increased gas exchange nearly threefold and hypoxia caused a return of the oxygen consumption almost to its initial level. It was concluded that hypoxia specifically inhibited the physiological mechanism of the body's temperature homeostasis. G.G.

N69-31429*# Israel Program for Scientific Translations, Ltd., Jerusalem.

MAXIMUM OXYGEN CONSUMPTION AND FUNCTIONAL STATE OF THE CIRCULATION IN SIMULATED ZERO GRAVITY [MAKSIMALNOE POTREBLENIE KISLORODA I FUNKTSIONALNOE SOSTOYANIE KROVOOBRASCHENIYA PRI IMITATSII NEVESOMOSTI]

V. S. Georgievskii et al *In its* The Oxygen Regime of the Organism and Its Regulation (Symp.) 1969 p 181–184 (See N69-31401 17-04)

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Elucidated were the effects of prolonged, strict bed rest on a subject's consistency of working at maximum intensity. Tests involved increasing physical loads before and after the stay in bed. In bicycle ergometer tests several respiratory and circulatory indexes were recorded in addition to work performed, oxygen consumption, and pulse rate. Experimental data revealed diminishing muscular activity following restriction of motor activity in all subjects. Although the maximum amount of work performed did not reach the normal level, the capacity for increasing energy production during increased duration of muscular work was retained. Performance of the same work following bed rest with restricted motor activity made severe demands on the cardiovascular system which in turn brought the circulation to its initial level. G.G.

N69-31430*# Israel Program for Scientific Translations, Ltd., Jerusalem.

PROBLEMS OF HYPOXIA IN SPORTS MEDICINE [PROBLEMY GIPOKSII V SPORTIVNOI MEDITSINE]

S. P. Letunov *In its* The Oxygen Regime of the Organism and Its Regulation (Symp.) 1969 p 185–194 (See N69-31401 17-04)

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An experimental model of strenuous muscular work, combined with artificial relative oxygen deficiency, was used to study athletic working capacity based on individual levels of reaction, stability, and resistance. The trained athlete's high working capacity was remarkable for its high resistance to hypoxic conditions caused by the stability and high intensity of his respiratory and circulatory functions during repeated muscular work. His energy supply to the motor system remained unimpaired and increased the phagocytic and enzymatic activities of the blood cells and the stability of the adrenal cortical indices. G.G.

N69-31431*# Israel Program for Scientific Translations, Ltd., Jerusalem.

MOTOR HYPOXIA [DVIGATELNAYA GIPOKSIYA]

A. B. Gandelsman *In its* The Oxygen Regime of the Organism and Its Regulation (Symp.) 1969 p 195–205 (See N69-31401 17-04)

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This paper elucidated the subject of hypoxic states during muscular work, their variations in relation to training, and the adaptation of athletes to hypoxia in strenuous, repetitive work. It was shown that several features distinguished motor hypoxia from other hypoxic states; it occurred in healthy people under normal atmospheric pressure, was more pronounced in trained persons with greater working capacity and against a background of high oxygen consumption. The high resistance of trained athletes to hypoxia was caused by adaptation as a result of repetitive motor hypoxia effects. Motor hypoxemia proved to include also a change of non-respiratory origin and probably involves adaptive opening of arteriovenous shunts in the pulmonary circulation, fluctuations in intrathoriatic pressure, gravity effects on the blood stream, etc. G.G.

N69-31432*# Israel Program for Scientific Translations, Ltd., Jerusalem.

MAXIMUM OXYGEN CONSUMPTION AS AN INDEX OF THE EXTENT OF OXIDATION PROCESSES AND GENERAL WORKING CAPACITY [MAKSIMALNOE POTREBLENIE KISLORODA KAK POKAZATELO BEMA OKISLITELNYKH PROTESSOV I OBSHCHEI RABOTOSPOSOBNOSTI ORGAN]

V. S. Farfel et al *In its* The Oxygen Regime of the Organism and Its Regulation (Symp.) 1969 p 206–210 (See N69-31401 17-04)

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Maximum oxygen consumption describes the upper limit of oxidation processes available to the body, and is increased to the extreme limit by strenuous muscular work. It depends upon the active body mass, age, and sex, is little affected by mild external stimuli, and reflects very clearly the total working capacity and training. Since oxygen consumption during work of moderate output bears a linear relationship to the actual work output, a high oxygen consumption by an athlete is regarded as an index of high work output. G.G.

N69-31433*# Israel Program for Scientific Translations, Ltd., Jerusalem.

OXYGEN EXCHANGE IN MAN DURING MUSCULAR ACTIVITY [KISLORODNYI OBMEN U CHELOVEKA PRI MYSHECHNOI DEYATELNOSTI]

N. I. Volkov et al *In its* The Oxygen Regime of the Organism and Its Regulation (Symp.) 1969 p 211–226 (See N69-31401 17-04)

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A kinetic model of oxygen exchange was developed and used to derive mathematical equations describing the oxygen consumption curve under various conditions. The model requires the oxygen consumption curve to follow a simple exponential relationship during moderately strenuous muscular work and a bi-exponential relationship during strenuous muscular work. A positive correlation between the kinetic constants and the rate of oxygen propagation through the metabolic space of the oxidation substrate was provided. G.G.

N69-31434*# Israel Program for Scientific Translations, Ltd., Jerusalem.

ROLE OF EXTERNAL RESPIRATION IN ENSURING MAXIMUM OXYGEN CONSUMPTION BY ATHLETES IN REPETITIVE MUSCULAR ACTIVITY [ROL VNESHNEGO DYKHANIYA V OBESPECHENII MAKSIMALNYKH VELICHIN POTREBLENIYA KISLORODA U SPORTSMENOV V UREMYA MYSHECHNOI DEYATELNOSTI TSIKLICHESKOGO TIPA]

M. V. Mikhailov *In its* The Oxygen Regime of the Organism and Its Regulation (Symp.) 1969 p 227–230 (See N69-31401 17-04)

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The efficiency of various regimes of external respiration in athletes during muscular work of submaximal intensity was studied with emphasis on nasal and oral respiration as well as on respiration with different frequency/depth ratios. Maximum pulmonary ventilation values were found to be 2 to 2.5 times larger in oral than in nasal respiration, while maximum oxygen consumption values were found to be correspondingly 1.5 times larger. Thus, in strenuous muscular work, oxygen supply was less efficient through the nose than through the mouth. G.G.

N69-31435*# Israel Program for Scientific Translations, Ltd., Jerusalem.

EFFECT OF HYPOKINESIA ON HUMAN RESPIRATION IN PHYSICAL WORK [VLIYANIE GIPOKINEZII NA KISLORODNYI REZHIM CHELOVEKA PRI FIZICHESKOI RABOTE]

B. S. Katkovskii *In its* The Oxygen Regime of the Organism and Its Regulation (Symp.) 1969 p 231–235 (See N69-31401 17-04)

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Studied were the effects of prolonged bed rest on human respiration at rest and in physical work. The latter provided a criterion for the assessment of physical work capacity. Experimental data indicated that even moderate work after prolonged hypokinesia increased the demands upon the cardiovascular, respiratory, and other systems due to lower economy and impaired control of respiration. G.G.

N69-31436*# Israel Program for Scientific Translations, Ltd., Jerusalem.

RELATIONSHIP OF CERTAIN OXYGEN PARAMETERS UNDER REDUCED BAROMETRIC PRESSURE AND IN ACCELERATION [VZAIMOOTNOSHENIE NEKTORYKH POKAZATELEI KISLORODNOGO REZHIMA ORGANIZMA PRI PONIZHENNOM BAROMETRICHESKOM DAVLENII I USKORENIYAKH]

E. I. Sorokina et al *In its* The Oxygen Regime of the Organism and Its Regulation (Symp.) 1969 p 236–238 (See N69-31401 17-04)

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Assessed were the oxygen exchange parameters in various forms of hypoxia through the oxidation-reduction (redox) potential of the muscles as observed by potentiometer. Results showed that a strengthening of the influencing factor markedly decreased oxygen tension and redox potential of the muscle during hypoxia. However, as the influencing factor grew stronger, the depletion of these reserves led to a more rapid decrease in both parameters until a plateau period was reached by the rapidly increasing changes in the body's respiration. The after effect period produces a gradual recovery of the original steady-state condition. G.G.

N69-31437*# Israel Program for Scientific Translations, Ltd., Jerusalem.

OXYGEN TENSION IN MYOCARDIUM AND BLOOD IN CIRCULATORY AND ANEMIC HYPOXIA [NAPRYAZHENIE KISLORODA V MYSHTSE SERDTA I KROVI V USLOVIYAKH TSIRKULYATORNOI I ANEMICHESKOI GIPOKSII]

V. I. Korolkov et al *In its* The Oxygen Regime of the Organism and Its Regulation (Symp.) 1969 p 239–242 (See N69-31401 17-04)

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Oxygen tension in the myocardium was studied as an index of its oxygen supply in correlation with variations in hemodynamics, total gas exchange, and blood gases. Oxygen tension measurements on hypoxic dogs by implanted ventricular electrode showed that high blood loss drastically lowered arterial blood pressure and reduced minute volume to nearly 1/5 of its original value. Replacement of almost half the volume with polyglucin compensated acute anemic hypoxia and its tension in myocardium and blood. G.G.

N69-31438*# Israel Program for Scientific Translations, Ltd., Jerusalem.

ACTIVE AVOIDANCE OF HYPOXIC ENVIRONMENTS BY ANIMALS AND MAN [OB AKTIVNOM IZBEGANII ZHIVOTNYMI I CHELOVEKOM GIPOKSICHESKIKH SRED]

I. S. Breslav *In its* The Oxygen Regime of the Organism and Its Regulation (Symp.) 1969 p 243–247 (See N69-31401 17-04)

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Human subjects and white mice were studied for their reactions to the inspiration of mixtures with low oxygen content and their preference reactions to various hypoxic environments. Results showed that both humans and animals avoided hypoxic environments and that this negative preference became greater at lower oxygen concentrations. Apparently, the negative preference for hypoxic environments was an integral index, related to increased strain on the control mechanism and caused by oxygen deficiency in inspired air. G.G.

N69-31439*# Israel Program for Scientific Translations, Ltd., Jerusalem.

OXYGEN SUPPLY IN ANEMIC AND CIRCULATORY HYPOXIA UNDER MOUNTAIN CONDITIONS [KISLORODNOE SNABZHENIE ORGANIZMA PRI ANEMICHESKOI ITSIRKULYATORNOI GIPOKSII V USLOVIYAKH VYSOKOGORYA]

A. Yu. Tilis *In its* The Oxygen Regime of the Organism and Its Regulation (Symp.) 1969 p 248–252 (See N69-31401 17-04)

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Dogs with vascular lesions and after blood loss, placed under conditions of mountain hypoxia, almost always increased the activity of their circulatory system, maintaining the body's oxygen supply and adapting to the lower partial pressure of oxygen. An animals' stay for one month in the mountains was not sufficient for complete acclimatization to conditions of hypoxia; thus, increased demands on the animal's compensatory mechanism led to heart lesions and blood loss. Complete acclimatization to mountain hypoxia occurred gradually and required prolonged periods. G.G.

N69-31440*# Israel Program for Scientific Translations, Ltd., Jerusalem.

ADAPTIVE REACTIONS TO BREATHING OXYGEN UNDER PRESSURES OF ITO 3 ATMOSPHERES [O PRISPOSOBITELNYKH REAKTSIYAKH ORGANIZMA PRI DYKHANII KISLORODOM POD DAVLENIEM OT ODNOI DO TREKH ATMOSFER]

A. G. Zhironkin et al *In its* The Oxygen Regime of the Organism and Its Regulation (Symp.) 1969 p 253–257 (See N69-31401 17-04)

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The main physiological reactions to breathing oxygen under high pressure constitute reduced pulmonary ventilatory volume and arterial oxygenation, vasorestrictive effects with slowing of blood circulation, and increased oxygen concentration in venous blood. Erythrocytes decreased 7% to 8% and hemoglobin 3% to 6% in human subjects during the first period of oxygen breathing; these changes were transient and pointed to a high oxygen concentration in inspired air. Observed respiration and hemodynamic reactions rapidly disappeared on resuming breathing of ordinary air. G.G.

N69-31441*# Israel Program for Scientific Translations, Ltd., Jerusalem.

OXYGENATION OF BLOOD AND CEREBRAL TISSUES WHILE BREATHING UNDER EXCESS PRESSURE IN A RAREFIED ATMOSPHERE [OKSIGNATSIYA KROVI I TKANEI MOZGA PRI DYKHANII POD IZBYTOCHNYM DAVLENIEM V RAZREZHENNOI ATMOSFERE]

I. N. Chernyakov et al *In its* The Oxygen Regime of the Organism and Its Regulation (Symp.) 1969 p 258–262 (See N69-31401 17-04)

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This paper presents the general results of polarographic investigations of oxygen supply to the body of animals (dogs), while breathing under excess pressure with compensatory mechanisms, at ground level and at altitude. Polarographic determinations were

performed of ρO_2 in the blood and in the cerebral tissues. Some of the experiments included investigations of ρCO_2 dynamics in the blood. The animals' generation condition was monitored by recording the pneumogram, EMG of abdominal muscles, and ECG. The excess pressure in the lungs was generated by a special device which supplied oxygen to an airtight helmet placed on the dog's head. The experiments established the dependence of the oxygen tension in blood and cerebral tissues upon the alveolar ρO_2, excess pressure in the lungs, and efficiency of the compensating system, in experiments carried out at ground level and at altitude. Oxygen breathing under ordinary pressure at ground level caused the ρO_2 to increase more than 6 times (up to 670 mm Hg) in the lungs but only 1–1.5 times (up to 155.6%) in the cerebral tissues. Author

N69-31442*# Israel Program for Scientific Translations, Ltd., Jerusalem.

CHANGE IN RESPIRATION DURING PREGNANCY, AND ITS SIGNIFICANCE IN INTRAUTERINE DEVELOPMENT [IZMENENIE KISLORODNOGO REZHIMA ORGANIZMA PRI BEREMENNOSTI I ZNACHENIE ETOGO IZMENENIYA DLYA VNUTRIUTROBNOGO RAZVITIYA ORGANIZMA]

M. G. Nemets *In its* The Oxygen Regime of the Organism and Its Regulation (Symp.) 1969 p 263–269 (See N69-31401 17-04)

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The oxygen consumption of pregnant rabbits was studied under conditions of basal metabolism during the last trimester of pregnancy by observing the state of physiological maturity in the newborne animals. It was found that the average oxygen consumption by pregnant rabbits, who subsequently gave birth to physiologically mature young, was 33% higher than the mean oxygen consumption by nonpregnant female rabbits. Injections of estrogen reduced oxygen consumption 15-42% and resulted in either immature young or in intrauterine death through inhibition of the pregnancy center in the CNS. Progesterone injections in nonpregnant female rabbits increased oxygen consumption analogous to same changes in pregnancy. Thus, it was concluded that increased oxygen consumption in pregnancy was maintained by progesterone via the pregnancy center. G.G.

N69-31443*# Israel Program for Scientific Translations, Ltd., Jerusalem.

ACTIVITY OF THIAMINE ENZYMES AT DIFFERENT OXYGEN SUPPLY LEVELS [AKTIVNOST TIAMINOVYKH FERMENTOV V USLOVIYAKA RAZLICHNOI OBESPECHENOSTI ORGANIZMA KISLORODOM]

Yu. V. Khmelevskii *In its* The Oxygen Regime of the Organism and Its Regulation (Symp.) 1969 p 270–275 (See N69-31401 17-04) Avail: CFSTI CSCL 06P

Observed was the part played by thiamine enzymes in the mechanism of the body's adaptation to variations in oxygen supply. Experimental determination of the pentose phosphate cycle (PPC) in hypoxic dogs and rats showed that the maximum transketolase activity (TA) of cardiac, cerebral, and hepatic tissues was found in newborne animals and decreased with increasing age. Embryonic and undifferentiated tissues showed a high level of glycolysis and of the activities of the enzymes of this cycle, in contrast to variations in the activity of the enzymes of these two systems of carbohydrate oxidation in mature tissues. It was concluded that the animal's maximum resistance to hypoxia coincides with the highest activity of the PPC enzymes. Administration of oxythiamine reduced the activity of thiamine enzymes in the cardiac and hepatic tissues of rats, and also reduced their survival in acute hypoxia. G.G.

N69-31444*# Israel Program for Scientific Translations, Ltd., Jerusalem.

CONTROL OF RESPIRATION IN THE BODY [O REGULIROVANII KISLORODYKH REZHIMOV ORGANIZMA]

A. Z. Kolchinskaya et al. *In its* The Oxygen Regime of the Organism and Its Regulation (Symp.) 1969 p 276–288 (See N69-31401 17-04)

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Briefly reviewed are the body's control mechanisms for pulmonary ventilation, cardiac output, oxygen transport, oxygen uptake, etc. An attempt is made to apply known principles of automatic control theory to analysis of the respiration control and to develop a structural scheme for this mechanism. General considerations for information transmission channels are outlined for the steady state condition, and the great constancy of partial oxygen pressure is extended to encompass the oxygen requirements in tissues that are under physical loads. G.G.

N69-31494# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

DEVELOPMENT OF A COLORIMETRIC PERSONAL DOSIMETER FOR NITROGEN DIOXIDE Final Report, Jul. 1967–May 1968

Robert F. Rakowski Dec. 1968 22 p refs

(AD-686423; AMRL-TR-68-104) Avail: CFSTI CSCL 6/20

A personal colorimetric dosimeter for nitrogen dioxide has been developed. Detector strips are prepared by dipping Eastman Chromagram Sheet, Type K301R2, in a solution of diphenylamine and oxalic acid in methanol. When dry, the strips can be used to estimate the concentration-time product to which an individual has been exposed. The strips are sensitive to heat and light. Nitrogen dioxide develops a green color while other oxidizers develop a blue color. The strips are not affected by moisture and should have a shelf life greater than one year. Color standards for concentration-time products of 50, 100, and 300 ppm-minutes and a blue standard to indicate an expired strip are described. A plastic holder for the sensitive detector strips is shown. Author (TAB)

N69-31517# Dartmouth Coll., Hanover, N.H. Dept. of Physiology.

METALLIC MICRONUTRIENTS AND INTERMEDIARY METABOLISM Annual Progress Report, Jun. 1968–Apr. 1969

Henry A. Schroeder Apr. 1969 12 p refs

(Contract DA-49-193-MD-2595)

(AD-686297; APR-2) Avail: CFSTI CSCL 6/16

In order to evaluate biological effects of trace elements, mice and rats were exposed for their lifetimes to small doses of each of many essential and abnormal elements in drinking water, in a laboratory and on a regimen designed to avoid environmental contamination. Growth rates, survival and longevity, microscopic pathology of tissues, concentrations of trace elements in tissues, and in rats, blood pressure, serum cholesterol, glucose and uric acid, aortic plagues and lipids and tumor rates were measured or examined. As a result of this work, two prevalent human diseases have been reproduced in rats. (1) A model for human arterial hypertension has been developed in rats fed cadmium. The pathological and physiological criteria are similar; e.g. hypertension, cardiac enlargement and renal arteriolar hypertrophy and early sclerosis. The hypertension can be controlled by removing the renal cadmium by chelation and replacing it with zinc in the chelate. (2) A model for human atherosclerosis has been developed in rats deficient in chromium and fed refined white sugar. The physiological criteria are similar; e.g. relative hypercholesteremia which increases with age, and mild to moderate hyperglycemia. The pathological manifestations were an increased incidence of aortic plagues, and increased aortic lipids; this aspect is being intensively restudied. These three changes were prevented by the feeding of trivalent chromium. Author (TAB)

N69-31535*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
CONTRIBUTIONS TO THE DEVELOPMENTAL MECHANICS OF EMBRYOS [BEITRAEGE ZUR EMBRYONALEN ENTWICKELUNGSMECHANIK]
Wilhelm Roux Washington NASA Jul. 1969 13 p refs Transl. into ENGLISH from Berslauer Aerz. Z., v. 6, 1884 p 57–62
(Contract NASw-1692)
(NASA-TT-F-12419) Avail: CFSTI CSCL 06C

The development of the frog (Rana fusca) eggs is studied in an environment with neutralized directive effect of gravity. It is observed that the fertilized eggs quickly orient themselves to the initial position, when disturbed in water, due to the differences in the specific gravity of the ovum parts. The ova was subjected to continuous revolution to alter the uppermost meridian, and cancel the directional gravity by centrifugal force. It is concluded that the development of the frog eggs occurs normally with no directive and formative action or force from without. F.O.S.

N69-31619*# Pennsylvania State Univ., University Park. Dept. of Biophysics.
SOLVENT EFFECTS IN THE RADIATION DEGRADATION OF DNA SOLUTIONS
Carl F. Blackman, Jr. (Ph.D. Thesis) Jun. 1969 86 p refs
(Grants NGR-39-009-008; NIH GM-1015)
(NASA-CR-103301) Avail: CFSTI CSCL 06A

Calf thymus DNA was prepared in three solvents and irradiated at 77°K for a series of doses and concentrations with cobalt 60 gamma rays. Alkali and neutral band sedimentation was used to obtain initial molecular weight distributions and the molecular weight of both single and double strand samples at each dose. This information was then converted to the number of molecular scissions per molecule by an equation for random scissions. The damage to DNA irradiated at 77°K and warmed to room temperature for analysis was enhanced when phosphate was present; this enhancement was attributed, in part, to indirect radiation action. Differences in the rates of single strand break production were attributed to solven modifications of radiation action. The double strand break production could be interpreted as resulting from an accumulation of single strand breaks and from directly-produced double strand breaks which occurred when a sensitive core (approximately 3 angstroms in diameter) is hit. Author

N69-31632*# Cornell Univ., Ithaca, N.Y. Dept. of Physiology.
DIRECTIONAL DOPPLER BLOODFLOW METER Progress Report
F. D. Mc Leod May 1969 43 p refs
(Grant NGR-33-010-074)
(NASA-CR-103316) Avail: CFSTI CSCL 06P

An ultrasonic blood flowmeter is studied which measures both velocity and flow by utilizing the Doppler effect in the sonic scattering from moving blood cells. A phase detection technique has been adapted for identification and separation of Doppler shifts produced by positive and negative velocity components. Two detectors are utilized, operating in quadrature to identify signal phase change, and thereby the direction of flow. It is concluded that the system is reliable and simple to operate; power requirements are small making it suitable for telemetry application; and reproducibility is better than five percent. F.O.S.

N69-31678*# Baylor Univ., Houston, Tex. Dept. of Psychiatry.
PHYSIOLOGICAL CORRELATES OF OPTIMAL PERFORMANCE Semiannual Status Report, 1 Dec. 1968–30 Apr. 1969
Robert Rossiter 30 Apr. 1969 12 p refs
(Grant NGR-44-003-031)
(NASA-CR-103302) Avail: CFSTI CSCL 05J

Further work has been accomplished in the following areas: data collection, data analysis, and the preparation and presentation of scientific papers. Author

N69-31684*# Neurosciences Research Program, Brookline, Mass.
BIOLOGY OF DRIVES: A REPORT OF AN NRP WORK SESSION
Elliot S. Valenstein (Fels Res. Inst.) 1 May 1968 114 p refs *Its* Bull. vol. 6, No. 1
Grants NGR-22-009-018; NIH GM-10211-06; Nonr(G)-00026-67)
(NASA-CR-103225) Avail: CFSTI 05J

In a definitive presentation, the diversity of motivational mechanisms and the nature of drive are discussed. Drive concepts and related behavioral phenomena are considered within the context of ethology, of the physiology, anatomy, and biochemistry of the brain, and of behavioral evolution. The neuroendocrine setting of behavioral propensities and the fractionation and differentiation of arousal processes are discussed on the basis of experimental data. An examination of drive and brain mechanisms deals with motivational and species-typical behavior elicited from the hpoothalamus and the preoptic region; the neurophysiological basis of feeding behavior, learning, and reinforcement; and the role of feeding and drinking centers outside of the hypothalamus. The relationships between drive, motivation, reinforcement, and learning are discussed as well as animal tests in reinforcement and motivation. The pharmacological aspects of the adrenergic and cholinergic systems are emphasized in a study of the biological mechanisms of reinforcement. An extensive bibliography on these subjects is included. K.W.

N69-31695*# Neurosciences Research Program, Brookline, Mass.
NEUTRAL CODING: A REPORT BASED ON AN NRP WORK SESSION
20 Dec. 1968 236 p refs *Its* Bull. Vol. 6, No. 3
(Grants NSG-462; NIH GM-10211-07; Nonr(G)-00014-68)
(NASA-CR-103228) Avail: CFSTI CSCL 06P

Candidate codes employing nerve impulses and trains on single channels are initially discussed, followed by a treatment of those codes involving multiple channels of pulse information and representation of information in nonimpulse carriers. The emphasis is on *how* information is represented, while the *meaning* of signals is not examined. Hormones and neurosecretions are considered in their roles as effector-exciters when released by nerve action, or as sensory stimuli when acting upon neurons. Some attention is given to slow and lasting representation of input and experience, such as various forms of altered excitability, electronic spread, intercellular channels, neuroglial influence, and diffuse as well as field effects. A catalog of candidate neural codes is included which contains brief descriptions of their formal properties and any existing evidence of their functional role in living organisms. K.W.

N69-31698# General Foods Corp., White Plains, N.Y.
DEVELOPMENT OF MOISTURE BINDING MIMETIC AGENTS Final Technical Report, Dec. 1966–Dec. 1967
Frank Hollis, Jr. Mar. 1969 72 p refs
(Contract DAAG17-67-C-0055)
(AD-685828; TR-69-50-FL; FL-81) Avail: CFSTI CSCL 6/6

Moisture mimetic agents and panel techniques have been identified and a bench-top procedure applied to dehydrated compressed food bars to eliminate or reduce the sensation of dryness. Preliminary studies have produced chicken stew, chicken, peas and cereal bars which have the prerequisite cube form, nutrition and reduced dryness when consumed. Sensory taste panel data have shown that the classes: polyhydric alcohols, sugars, fruits, fats and oils exhibit beneficial moisture mimetic properties as additives to compressed dehydrated foods. Rehydration, storage and structural stability tests are reported. Author (TAB)

N69-31780# National Institutes of Health, Bethesda, Md. Translating Unit.
KINETICS OF CELL POPULATIONS
M. Tubiana 25 Apr. 1969 36 p refs Transl. into ENGLISH from Ann. Biol. Clin. (Paris), v. 26, no. 7–9, 1968 p 793–823
(Rept-4-35-69) Avail: Issuing Activity

Cell population kinetics is studied by using isotopic labeling, by which the cells are followed through their migrations, or morphological modifications during the process of maturation and differentiation. It is shown that any cell labeling technique must meet the following criteria: binding between label and the cell must be stable; labeling must be specific, i.e. if the cell dies, the label must not be incorporated by another cell; labeling must not modify the behavior of the cell; and must not be toxic. Labeling techniques for different cells are reviewed. Tumor growth, and the kinetics of cell proliferation in tumors are analyzed. Charts summarizing the cell population behavior of various tissues are included. F.O.S.

N69-31780# National Institutes of Health, Bethesda, Md. Translating Unit.
POSTRADIATION RECOVERY OF YEAST CELLS SIMULTANEOUSLY FROM LETHAL AND SUBLETHAL DAMAGES
V. S. Barsukov, O. V. Malinovskii, and N. M. Mitiushova 27 Jan. 1969 15 p refs Transl. into ENGLISH from the Russian
(Rept-1-21-69) Avail: Issuing Activity

The postradiation recovery of a quiescent culture of the yeast S. cerevisiae strain 16 × 32 aa-alpha-alpha, at fractional irradiation with Co^{60} gamma rays was examined. Determined was the survival rate dependency on the fractionation interval at the sowing on a nutrient medium immediately after the second fraction of irradiation. Comparison of experimental data with calculated variants showed that the observed increase of survival rate can be explained only by a simutaneous recovery from lethal and sublethal damages. The process of recovery from lethals contained an inhibiting effect on the recovery from sublethals. This phenomenon was explained by the fact that at recovery the lethal damages were liquidated not as a single complete entity but gradually, converting first into sublethals. The difference of the lethals and the sublethals was quantitative prior to the fixation of the lethals. Author

N69-31782# National Institutes of Health, Bethesda, Md. Translating Unit.
DISTRIBUTION OF INTERPULSE INTERVALS IN THE BACKGROUND ACTIVITY OF NEURONS OF THE CAUDATE NUCLEUS, THE RETICULAR FORMATION, AND THE CEREBRAL CORTEX OF THE RAT
B. F. Tolkunov 27 Feb. 1969 17 p refs Transl. into ENGLISH from Zh. Vysshei Nervnoi Deyatel Nosti (Moscow), v. 18, no. 4, 1968 p 691–700
(Rept-2-26-69) Avail: Issuing Activity

Investigated are the characteristics of the distribution of the interpulse intervals in the background activity of the neurons of two large nonspecific formations with reticular structure: the caudate nucleus and the reticular formation of the rat midbrain. The data obtained are compared with results of the investigation of the neurons of the temporal-parietal area of the cerebral cortex. The internal histograms (IH) of the different neurons have varied form; the character of the IH's being, especially in the region of the top of the distribution, not connected with the frequency of the impulse pattern for one and the same neuron during the long period of stimulation. According to the curve of postimpulse probability (PP) all IH's, and consequently the neurons also, may be divided into: (1) neurons, the PP of which increases monotonically and reaches a plateau; and (2) neurons, the PP of which passes through the maximum as a consequence of increased exitability. Neurons of the second type are present in the caudate nucleus in a higher degree than in the reticular formation and the temporal-parietal region of the cerebral cortex. Author

N69-31788# School of Aerospace Medicine, Brooks AFB, Tex.
THE EFFECTS OF ULTRAVIOLET RADIATION ON THE EYE Final Report, 1 Sep. 1966–30 Sep. 1968
Donald G. Pitts, John E. Prince, Harold W. Casey, Kenneth R. Kay, and Robert W. Bowman Feb. 1969 135 p refs
(AD-685724; SAM-TR-69-10) Avail: CFSTI CSCL 6/5

An argon gas forced transpiration arc (FTA) source used to produce a high intensity 180 nm to above 2.5 micron continuous spectrum was described. Calibration technics, monitoring instrumentation and procedures for studying the effects of ultraviolet on the eye were presented. An ultraviolet space energy profile was composed using data from rocket flights. Author (TAB)

N69-31796# Naval Submarine Medical Center, Groton, Conn. Submarine Medical Research Lab.
LIGHT FLASHES, PUPIL SIZE AND VISUAL PERFORMANCE: AN ANALYSIS OF DISCOMFORT IN THE USE OF ELECTRO-OPTICAL AIDS
Jo Ann S. Kinney, Leah T. Spitz, and S. M. Luria 22 Jan. 1968 15 p refs
(AD-686025; SMRL-558) Avail: CFSTI CSCL 6/16

Two measures of subjects response to brief, bright lights in their field of view have been made: (1) subjective judgements of discomfort and (2) objective measures of the amount of pupil constriction to the lights. These measures were made both before and after a long term visual search task. The results showed that those subjects who performed the search under conditions simulating the use of electro-optical aids did have greater discomfort and pupil constrictions in response to the lights. There was, however, no concomitant decrement in visual performance. Author (TAB)

N69-31799# Michigan State Univ., East Lansing. Div. of Engineering Research.
CLASSIFICATION OF ELECTRO-ENCEPHALOGRAMS WITH PATTERN RECOGNITION ALGORITHMS Interim Scientific Report
Richard C. Dubes, Albert Hung, and W. R. McCrum Mar. 1969 39 p refs
(Grant AF-AFOSR-1023-67)
(AD-685734; AFOSR-69-0964TR; ISR-4) Avail: CFSTI CSCL 6/3

The report proposes a mathematical model for making decisions about the condition of a subject from EEG data and algorithms for implementing the model. Pattern recognition methods are combined with the experience of a practicing electroencephalographer to balance the availability of mathematical models, computational feasibility, and experience. The aim of the model building is to produce a computationally feasible algorithm for a digital computer that generates a chart showing the condition of the subject as a function of time. The report gives preliminary results on feature extraction. In its present version, the pattern recognizer treats feature extraction and pattern classification distinctly and limits learning to transition probabilities of the Markov chain. The decision procedure that is outlined is applicable to any model that defines discrete states and permits Markovian movement between states. Author (TAB)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N69-31204# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
COMPUTER SYSTEMS FOR TEACHING COMPLEX CONCEPTS Final Report, 1 Oct. 1963–30 Sep. 1968
Wallace Feurzeig Mar. 1969 191 p refs
(Contract Nonr-4340(00))
(AD-684831; BBN-1742) Avail: CFSTI CSCL 5/9

This research concerns various ways of using computers for teaching problem-solving concepts and skills. New lines of approach to programmed teaching, programming, and instructional monitoring were investigated in various instructional contexts including mathematics, physics, and medicine. Four programming systems--Mentor, Stringcomp, Simon, and Logo--were designed and used as an integral part of these investigations. The systems are described and their capabilities demonstrated in instructional applications of several kinds. The work suggests some new ways in which computers might make valuable contributions to education. (1) The teaching of appropriate programming languages can provide a conceptual and operational framework for the teaching of mathematics. (2) Utilizing diagnostic cues, instructional monitors can enhance the teaching of practical subjects (navigation, languages, music) whose mastery requires the integration of mechanical and intellectual skills. Author (TAB)

N69-31362*# Naval School of Aviation Medicine, Pensacola, Fla. Naval Aviation Medical Center.
BIOTELEMETRY OF THE TRIAXIAL BALLISTOCARDIOGRAM AND ELECTROCARDIOGRAM IN A WEIGHTLESS ENVIRONMENT
W. Carroll Hixson and Dietrich E. Beischer 8 Sep. 1964 98 p refs *Its* Monograph No. 10
(NASA ORDER R-20)
(NASA-CR-103320) Avail: CFSTI CSCL 06B

The report describes in detail the design and development of the constraint platform with attached biotelemetry module used to transduce, signal condition, and telemeter the physiological measurements. A similar description is given of the airborne receiving station used to receive, display, and store the telemetered data. Linear and angular acceleration measurements were performed with this equipment and the results represent the first recording of a triaxial inertial acceleration ballistocardiogram. Triaxial electrocardiographic data were simultaneously measured and telemetered to permit correlation of the mechanical and electrical events of the cardiac complex. The linear acceleration patterns were also displayed in loop form and in a three-dimensional arrangement to facilitate interpretation of their spatial relationship. Analog computer operations were performed on the flight data to obtain a continuous trace of the absolute magnitude of the instantaneous BCG and ECG vector. Differences between the flight BCG and the laboratory based BCG data are noted and discussed. Author

N69-31373# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONSTRUCTION AND OPTIMIZATION OF ALGORITHMS OF RECOGNITION OF RELATION
L. M. Fridman Jul. 1968 24 p refs Transl. into ENGLISH from Programmirovannoe Obuchenie i Obuchayushchie Mashiny (USSR), no. 1, 1966 p 3–21
(AD-682408; FTD-MT-24-197-68) Avail: CFSTI CSCL 5/9

The problem of recognition whether or not the test object is in a given relation with a definite pattern is theoretically examined; examples: Is this parallelogram a square, Is this letter k. A method of writing this problem in mathematical symbols is suggested. In a determinate problem, the solution algorithm is based on a set of indicants A sub k which serves as a logical definition. This definition meets these two conditions: (1) The generic concept used in the definition indicates the relation (set A); (2) The specific indicants (A sub k) are actually verifiable. This definition is written down by means of logic symbols and a corresponding graph, which is treated as the sought-for algorithm, is constructed. The programed learning includes a preliminary study of all kindred recognition problems and finding the optimal algorithm for which a quantitative evaluation is needed. TAB

N69-31493# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
EFFECT OF CONFIRMATION PEEKING AND RESPONSE MODE ON PROGRAMMED INSTRUCTION Final Report, Apr. 1965–Jan. 1966
Horace H. Valverde Dec. 1968 33 p refs
(AD-686422; AMRL-TR-67-225) Avail: CFSTI CSCL 5/9

An experiment was conducted to determine the effect of peeking on programmed instruction. The study tested the following hypotheses: (1) the requirement for overt responses does not increase learning in programmed instruction, (2) devices or formats to preclude confirmation peeking do not increase the effectiveness of programmed instruction, and (3) time can be saved by eliminating the requirement for overt responses. Two groups of 30 subjects each were used. The subjects were commissioned officer Air Force pilot trainees and Air Force Reserve Officer Training Corps (AFROTC), junior and senior college students matched on the basis of scores obtained on the Officer Quality Composite of the Air Force Officer Qualifying Test (AFOQT). The stimulus material was a radar orientation programmed text. Results of the study were: (1) peeking did not reduce the effectiveness of programmed instruction; (2) students who responded covertly learned as efficiently as students who responded overtly; and (3) covert responding did not save instructional time. Author (TAB)

N69-31647*# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
THE HUMAN OPERATOR IN CONTROL SYSTEMS
George A. Bekey Mar. 1969 64 p refs
(Grant NGR-05-018-022)
(NASA-CR-103307; USCEE-359) Avail: CFSTI CSCL 05E

The material presented first introduces the subject of man–machine systems and indicates some of the input–output characteristics of man. The psychological and engineering approaches to the description of man as a control element are then discussed. Display and control factors are reviewed briefly, with some examples of actual and proposed systems. The engineering approach to control systems is then indicated, and some mathematical models of the human operator's function are presented. Finally, simulation of manned systems is examined briefly, indicating the considerations of stimuli, experimental design, and evaluation criteria. Author

N69-31677# Texas Christian Univ., Fort Worth. Inst. for the Study of Cognitive Systems.
PARAMETERS OF HUMAN PERCEPTION Semiannual Report, Apr.–Sep. 1968
Selby H. Evans Sep. 1968 38 p refs
(Contract DAAD05-68-C-0176; Proj. THEMIS)
(AD-685845; SAPR-2) Avail: CFSTI CSCL 5/10

Primary attention was directed to the development of computer systems to produce patterns which simulate aspects of patterns in practical pattern identification tasks, particularly the variability within identification classes. Several pattern simulation systems are described and illustrative output is presented. Other methodological aspects of the research program are described, including investigation of certitude ratings and posterior probabilities as responses in pattern identification. Empirical and theoretical aspects of the research are also discussed; the development and testing of a computer program to simulate human performance in a pattern identification task is noted and further exploration of systems for image enhancement and analysis are described and illustrated.
Author (TAB)

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N69-30412# Aerospace Corp., El Segundo, Calif. Lab. of Operations.
TABLE OF THE KASSEL INTEGRAL
George Emanuel 20 Feb. 1969 137 p refs
(Contract F04701-68-C-0200)
(AD-685157; TR-0200(4240-20)-5; SAMSO-TR-69-36) Avail: CFSTI CSCL 7/4

Values of the Kassel integral are tabulated to five decimal places. In the text the Kassel integral is derived, certain useful limits for it are given, and the numerical method, including its accuracy, is explained.
Author (TAB)

N69-30444# Aerospace Corp., El Segundo, Calif. Lab. of Operations.
THE DISSOCIATION OF HBr IN SHOCK WAVES
R. R. Giedt, N. Cohen, and T. A. Jacobs 31 Dec. 1968 27 p refs
(Contract F04701-68-C-0200)
(AD-685158; TR-0200(4240-20)-6; SAMSO-TR-69-38) Avail: CFSTI CSCL 7/4

Shock tube studies were made of the thermal dissociation rate of HBr in the 2100°-4200°K temperature range, using IR emission and UV absorption techniques. It was necessary to invoke a low activation energy (compared to bond energy) in order to explain the HBr dissociation data. It was also found that HBr is about fifteen times more efficient than Ar as a collision partner in dissociating HBr.
Author (TAB)

N69-30465 Stanford Univ., Calif.
AN EPR STUDY OF Cr ION AND EXCHANGE-COUPLED Cr ION PAIRS IN THE BiI SUB 3 STRUCTURE
Robert William Bene (Ph.D. Thesis) 1968 64 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 69-194

This paper reports the results of an EPR study of Cr^{3+} single ions in BiI_3 and SbI_3, and exchange-coupled pairs of Cr^{3+} ions in BiI_3. Two of the results are rather unusual; a g-value greater than 2, and an anistropic exchange parameter about one fifth the isotropic exchange parameter. Explanations which involve the quite high covalent bonding and the extremely large spin-orbit constant on the halogens are given for both unusual parameters. The relevance of the EPR results to the magnetic anistropic in the chromium tri-halides is discussed. Also observed and included in this report is the Cr^{2+} single-ion spectrum of $Cr:BiI_3$.
Dissert. Abstr.

N69-30533*# Scripta Technica, Inc., Washington, D.C.
DETERMINATION OF THE OXYGEN CONTENT OF SODIUM AND OF THE SODIUM-POTASSIUM ALLOY BY VACUUM DISTILLATION
I. B. Dmitryeva et al *In its* Liquid Metals May 1969 p 318–323 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 07D

An experimental method for determining oxygen content in liquid sodium is presented. Apparatus for performing the measurements is described as well as analysis of the obtained results.
Author

N69-30536*# Scripta Technica, Inc., Washington, D.C.
THE USE OF HOT TRAPS FOR REMOVING OXYGEN FROM SODIUM
F. A. Kozlov et al *In its* Liquid Metals May 1969 p 340–356 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 07D

The paper gives a thorough description of theoretical and practical aspects of the use of hot traps for oxygen removal from sodium. The reaction of zirconium cladding with the oxygen is considered as a function of time of exposure, temperature, concentration, liquid metal velocity, changes in chemical composition. Methods of testing the cladding by X-ray diffraction and metallographic analysis are described along with the changes in its electrical resistivity.
Author

N69-30583 Pennsylvania Univ., Philadelphia.
DEFORMATION AND DIPOLAR DEFECTS IN SODIUM CHLORIDE
Melville Carl Shine, Jr. (Ph.D. Thesis) 1968 214 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 69-171

The complex dielectric constant of deformed specimens of NaCl was measured as a function of strain, temperature and time after deformation. For this purpose a vacuum cryostat was constructed in which precision capacitance measurements could be made under controlled conditions. It was found that the dielectric constant increased at first after deformation followed by a slower decrease with time. A detailed kinetic analysis showed conclusively that the increase in dielectric constant occurred with an activation energy of 0.74 eV and with second order kinetics, while the decay was characterized by an activation energy of 0.64 eV and first order kinetics. The discovery that the major sinks for the vacancies at 3% strains are the Ca^{++} impurities is entirely new. This was determined from the decay kinetics and the extraction of the Debye behavior of Ca^{++}-vacancy dipoles.
Dissert. Abstr.

N69-30576 Tennessee Univ., Knoxville.
INVESTIGATION OF THE EXCITATION MECHANISM OF THE OH RADICAL IN HYDROGEN FLAMES
Montie Grant Davis (Ph.D. Thesis) 1968 125 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-1238

The radiation from combustion flames is above that expected thermally. Previous studies have shown this excess radiation to be due to one of several chemical reactions. However, the particular reaction responsible for the excess excited OH molecules was

elusive. This study, by analytical reasoning of previous results together with results obtained in this study, eliminates all except one of these reactions. Spectroscopic measurements were made of OH concentration, temperature, and OH radiation from $^2\Sigma - ^2\pi$ transition in several H_2-O_2 flames. These flames had different equivalence ratios and were diluted with different quantities of diluent gases. Dissert. Abstr.

N69-30580 Illinois Univ., Urbana.
DESTABILIZATION-AGGREGATION OF DILUTE COLLOIDAL SUSPENSIONS BY POLYELECTROLYTES
Roger Miles Jorden (Ph.D. Thesis) 1968 154 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-1367

An empirical equation for the aggregation of destabilized colloidal suspensions has been developed. It has been found that the rate of decrease of supernatant turbidity of mildly agitated, dilute colloidal suspensions undergoing aggregation is approximately second-order with respect to supernatant turbidity. This has been found to be true for a wide range of conditions and for a number of types of systems where destabilization is accomplished by different types of mechanisms. The second-order rate constant for the decrease of turbidity qualitatively shows the same response to a change of variables as does the rate of aggregation which is suggested by theory for relatively simple cases. Dissert. Abstr.

N69-30584 Tennessee Univ., Knoxville.
A STUDY OF THE FOREIGN GAS BROADENING OF THE SPECTRAL LINES IN THE FUNDAMENTAL VIBRATION–ROTATION BAND OF HYDROGEN FLUORIDE BY CARBON DIOXIDE
Barry Martin Shaw (Ph.D. Thesis) 1968 98 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-1265

The shifts due to the presence of a foreign noninteracting gas of the spectral lines P(4)-R(6) of the fundamental vibration–rotation band of hydrogen fluoride were measured. A constant HF pressure of 2.15 cm of mercury was used, and to this was added 25, 50, 75, and 100 psi of CO_2. For each line the shift was found to be proportional to the CO_2 pressure. A new approach to the application of the equivalent width method was developed. In previous experiments the line intensities had been determined from a knowledge of X_2/x_1, where x is the parameter defined in the Ladenburg–Reiche equation, and 1 and 2 refer to the different experimental conditions required for the determination. Also the line shapes were investigated for the lines which could be slit corrected. It was found that the Lorentz exponent changed from the value of 2.0 for the narrowest lines to a value of approximately 1.85 for the widest lines investigated. Dissert. Abstr.

N69-30593# Northwestern Univ., Evanston, Ill.
ELASTIC AND MAGNETIC STUDIES OF URANIUM DIOXIDE
Ogden Grenville Brandt (Ph.D. Thesis) 1968 167 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-1801

Uranium dioxide is a material which exhibits anomalous behavior in both its magnetic and elastic properties. The purpose of this investigation was to determine the nature of the coupling between the atomic elastic and magnetic properties implied by the thermal conductivity results, by means of the propagation of ultrasonic waves. Since UO_2 crystallizes in the cubic CaF_2 structure, there are three independent elastic constants: C_{11}, $C' = C_{11}-C_{12}$ and C_{44}. These were measured from room temperature to 10°K (by means of a method developed during the course of the investigation), and the attenuation of the sound waves associated with these elastic constants was measured from 70° to 10°K. In addition, the magnetic susceptibility was measured in the principle crystallographic directions over the temperature range from 300° to 4.2°K, as were the length changes upon cooling through the transition. Dissert. Abstr.

N69-30603 Boston Univ., Mass. Graduate School.
ANOMALIES IN CHROME ALUMS
Tahira Minhaj Servaes (Ph.D. Thesis) 1968 201 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 68-18100

In this thesis an explanation has been sought for the anomalies in chrome alums. The chromium ion in the alums has an odd number of electrons and it has been reported that at low temperatures it exhibits a non-degenerate ground state. The electrostatic interactions of two Cr^{3+} ions have been evaluated at length; an estimate of super-exchange effects is made; the influence of the first neighbor is found to be zero. The conclusion reached is that the source of the said anomalies does not depend on the effects considered in this thesis. The necessary calculations include evaluation of the overlap integrals, electron-nucleus interaction integrals at two centers, and electron–electron Coulomb integrals at two centers. Slaters nodeless radial functions were employed and a Fourier transform technique of integration was used to obtain results in closed form. Dissert. Abstr.

N69-30607 Clarkson Coll. of Technology, Potsdam, N.Y.
THE OPTICAL SPECTRA OF TRIVALENT CHROMIUM IONS IN SOLUTIONS AND HOST CRYSTALS
David Michael Winch (Ph.D. Thesis) 1968 134 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-17955

The optical spectra of Cr^{3+} ions in solutions and host crystals were investigated using a Cary 14, a Hilger Littrow, and an Abney mounting spectrograph. The influence of temperature and concentration on the wavelengths and half-widths of the band spectra of solutions of $KCr(SO_4)_2 \cdot 12H_2O$, $Cr(NO_3)_3 \cdot 9H_2O$ and $CrCl_3 \cdot 6H_2O$ and the line spectra of crystals of $KCr(SO_4)_2 \cdot 12H_2O$, and Cr_2O_3:MgO was measured. The temperature dependent results were compared with the phenomenological theory of McCumber and Sturge. An attempt was made to develop a less arbitrary theory based on the Born–Oppenheimer adiabatic approximation. Dissert. Abstr.

N69-30608 Washington Univ., Seattle.
A STUDY OF ALKANOIC ACIDS BY COLD NEUTRON TRANSMISSION
Duaine Gerald Lindstrom (Ph.D. Thesis) 1968 220 p
Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 69-1192

A systematic study of seven light alkanoic acids was carried out using the method of cold neutron transmission. Over a temperature range of about 50°C, the transmitted fraction of a beam of low energy neutrons was measured for each acid. Using sample densities measured by a beam of epi-cadmium neutrons, the cross sections of the samples were calculated. Counting times and neutron speeds were chosen to statistically optimize calculation of the slopes of cross sections versus wavelength. A detailed analysis of the mechanical velocity selector was carried out using a Monte Carlo type calculating routine. The resolution function which resulted from the analysis was used as a basis for resolution corrections to the measured cross sections. As a result of the measurements it was concluded that for the six lightest members of the acid series a mixture of polymers and dimers exists with a greater tendency for polymers in solids and in the lightest acids. Dissert. Abstr.

N69-30615 California Univ., Davis.
THE MOESSBAUER RECOILLESS FRACTION OF GOLD
Robert William Ohlwiler (Ph.D. Thesis) 1968 113 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-815

The Mossbauer recoilless fraction, f, of the 77 keV gamma ray of Au^{197} in a gold metal absorber was measured as a function of temperature between 4.5 and 100°K. The source was Au^{197}

in platinum metal. The Mössbauer spectrum was fit with the absorption integral, and the recoilless fraction was derived from the shape and width of the spectrum. Then *f* varies between 0.17 at 4.5°K and 0.01 at 100°K. The analysis indicates that the source and absorber lines are Lorentzian and have approximately equal widths, 0.937±0.011 mm/sec. Shirley's theoretical estimate of the internal conversion coefficient, 3.96±0.14, was shown to be approximately correct. The Debye temperature versus temperature corresponding to the measured recoilless fraction was compared to that derived from theoretical phonon frequency distributions reported in the literature. An appendix gives many general properties of the Mössbauer absorption integral. Dissert. Abstr.

N69-30628# Kernforschungsanlage Juelich (West Germany). Institut fuer Physikalische Chemie.

MASS-SPECTROMETRIC STUDY OF NITROGEN-CONTAINING ORGANIC COMPOUNDS (TRISPYRROLIDINOBENZENE AND OXIDATION PRODUCTS) WITH THERMAL IONIZATION [MASSENSPEKTROMETRISCHE UNTERSUCHUNG STICKSTOFFHALTIGER ORGANISCHER VERBINDUNGEN (TRISPYRROLIDINOBENZOL UND OXIDATIONSPRODUKTE) MIT THERMISCHER LONISIERUNG]

H. Ihle and A. Neubert Jan. 1969 22 p ref In GERMAN
(JUL-570-PC) Avail: CFSTI

The molecular weights of organic nitrogen compounds, which are readily decomposed by heat, have been determined mass spectrometrically by thermal ionization. The mass determination in the range 500 to 600 mass units is possible with an accuracy of $\Delta M = \pm 0.5$ mass unit. From the mass distribution of the ions, the species present can be identified, and the progress of the thermal decomposition can be followed. Author

N69-30684*# Nevada Univ., Reno. Mackay School of Mines.

SURFACE CHEMISTRY OF MAJOR ROCK TYPES OF SONORA PASS TEST SITE, CALIFORNIA

Jack G. Quade, Peter E. Chapman, and Peter A. Brennan Jun. 1968 19 p refs *Its* Tech. Letter No. 12
(Grant NGR-1-38-7754)
(NASA-CR-101767) Avail: CFSTI CSCL 07B

The chemical study of the weathered or altered surface layer of selected rock samples from Sonora Pass Test Site is embodied in this report. The chemical compositions are tabulated and reported as oxide percentages. In addition, reconstitution to normative minerals are shown. The normative minerals do not reflect all aspects of the true mineralogy, but variations in normative minerals may reflect subtle changes in several of the oxides. Author

N69-30736 Pennsylvania Univ., Philadelphia.

THE DIFFUSION OF OXYGEN AND SULFUR IN LIQUID IRON

Russell Lawrence McCarron (Ph.D. Thesis) 1968 251 p
Avail: Univ. Microfilms: HC $11.50/Microfilm $3.25 Order No. 69-142

The diffusion coefficient of oxygen and the diffusion coefficient of sulfur in liquid iron at 1560°C have been determined by a capillary gas-reservoir technique. Combination of the equilibrium values for %O and %S with the total amount of diffusate entering the liquid iron was used to calculate the diffusion coefficients from the solution to Fick's second law for diffusion in the semi-infinite medium. Results were obtained for oxygen and sulfur at 1560°C. The results of ancillary experiments at 1660°C supported the experimental results at 1560°C. An important result of this study is the significant difference between the diffusivity of oxygen in liquid iron and that of sulfur in liquid iron. This result is shown to be in qualitative agreement with Swalin's fluctuation model for solute diffusion in liquid metals. Dissert. Abstr.

N69-30792# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France).

DETERMINATION OF URANIUM IN SOLUTION BY MEASURING INTERNAL CONVERSION X-RAYS [DOSAGE DE L'URANIUM EN SOLUTION PAR LA MEASURE DU RAYONNEMENT X DE CONVERSION INTERNE]

R. Bourseau, P. Fabre, and E. Zini *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 249–254 In FRENCH; ENGLISH summary (See N69-30776 17-13)
(SM-112/17) Avail: CFSTI

The measurement of internal conversion X-rays of uranium can be used for determining the uranium content of solutions. This can be done by titrating from as little as 10 mg of uranium per litre, the volume of sample required being 20 ml, and the measurement time about 10 min. The equipment used is of the standard type: a thin-crystal scintillation detector, and a single-channel collector with a scaler. Certain daughter elements of uranium emit X-rays in the same energy band; however, simple procedures have been developed for eliminating them in both acid and alkaline solutions so as to obviate errors due to disruptions of radioactive equilibrium. Thus, the method described can be used for the determination of natural as well as industrial solutions and is applicable to the content of all solutions actually encountered in operations, from drainage waters to factory processing waste. Author

N69-30808# Bureau of Mines, Albany, N.Y. Metallurgy Research Center.

ALKALIZED-ALUMINA ATTRITIONING AND SULFUR DIOXIDE SORPTION RATES

Joseph W. Town, Philip E. Sanker, and Hal J. Kelly Jul. 1969 33 p refs
(BMRI-7275) Avail: Issuing Activity

Studies were conducted related to SO_2 air pollution to determine attritioning rates, SO_2 sorption rates, and sulfur loads that could be obtained on commercial alkalized alumina sorbent pellets. Fluidized-bed attritioning rates ranged from 0.025 pct/hr for alkalized alumina with a crushing strength of 4 kg to 0.075 pct/hr for 0.5 kg crushing strength material. Airlift attritioning rates ranged from 0.50 pct/hr for 3 kg crushing strength alkalized alumina to about 3 pct/hr for 0.5 kg material. Attritioning rates for the commercial alkalized alumina were comparable to those obtained for sorbent pellets prepared in the laboratory. Sorption rates were related to SO_2 concentration in flue gas, temperature, and presence of nitrogen oxides in the gas stream. Sorption rates at 300° C were 0.35×10^{-5} gS/gp/sec (grams sulfur per gram pellet per second) in 0.045 pct SO_2 gas, 5.1×10^{-5} gS/gp/sec in 0.34 pct SO_2 gas, and 65×10^{-5} gS/gp/sec in 10 pct SO_2 gas. For the 0.34 pct SO_2 gas, sulfur loads of 0.10 gS/gp (the projected load for regeneration) were obtained in 47 min at 130°C and in 116 min at 300° C. The presence of either NO or NO_2 in the 0.34 pct SO_2 gas increased the SO_2 sorption rates 2 to 3 times at 300° C, but had no effect at 130° C. Author

N69-30825 Rutgers Univ., New Brunswick, N.J.

THE SPECIFIC HEATS OF SOLID XENON

John Ulric Trefny (Ph.D. Thesis) 1968 85 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-17816

The specific heat of crystalline xenon in equilibrium with its vapor was measured from 18°K to the triple point. A continuous heating adiabatic calorimeter containing a platinum resistance thermometer was used to make the measurements. The results were supplemented by recent experimental values in the temperature range 1.5° to 24°K. From the data the specific heat of the solid at constant pressure and the entropy were obtained. The temperature variation of the Gruneisen parameter was evaluated. The behavior of the characteristic temperatures, $\theta(T)$, obtained from the entropy,

and $\theta^4(T)$, obtained from the constant volume specific heat, was found to depart significantly from quasi-harmonic theory predictions. This departure was also evident in the temperature variation of the Grueneisen parameter. The function $\theta^4(T)$ was analyzed in the temperature range 20° to 80°K for anharmonic content. The results of the analysis were compared with recent theoretical calculations of the leading anharmonic contributions. Dissert Abstr.

N69-30827# Commissariat a l'Energie Atomique, Paris (France).
REUSE WITHOUT REGENERATION OF RADIOTHERMOLUMINESCENT LITHIUM FLUORIDE [REEMPLOI SANS REGENERATION DU LITHIUM FLUORIDE RADIOTHERMOLUMINESCENT]
Guy Portal, Henri Francois, and Philippe Blanchard [1968] 16 p refs In FRENCH Presented at 1st European Congr. on Radiation Protect. and Exhibition on Equipment using Low Energy and Short Range Radiation Dosimetry, Menton, France, 9 Oct. 1968
(CEA-CONF-1138; CONF-681013-6) Avail: AEC Depository Libraries

A lithium fluoride was prepared which has less developed unstable peaks than commercial material and which can therefore be reused without regeneration. Regeneration is the annealed operation made after the use of a sample in order to restore its initial quantities to it. The term annealed is applied to the first operation made after the preparation of the fluoride in order to give it the characteristics sought. The annealing conditions are described in detail. The LiF prepared was used for the manufacture of Teflon detectors which were used about sixty times. The detectors have excellent reproducibility even for low irradiations. NSA

N69-30860*# Honeyville, Inc., Montgomeryville, Pa. Livingston Electronic Lab.
DEVELOPMENT OF HIGH ENERGY DENSITY PRIMARY BATTERIES Final Report, 31 May 1967–30 Apr. 1968
S. G. Abens, W. C. Merz, and C. R. Walk Apr. 1968 114 p refs
(Contract NAS3-10613)
(NASA-CR-72535) Avail: CFSTI CSCL 07D

Experimental work for the development of CuF_2–Li primary batteries was conducted. With methyl formate–$LiAsF_6$ electrolyte, 150 and 92 Wh/lb were obtained at 4.3 and 51 mA/cm^2, respectively. The lithium anodes were stable in this electrolyte. Purification of CuF_2 improved wet life, but depressed discharge potential of cells having propylene carbonate electrolyte. Purification of electrolyte did not improve CuF_2 electrode performance significantly. Author

N69-30879*# National Aeronautics and Space Administration, Washington, D.C.
PROPERTIES OF TRICOBALT TETROXIDE POWDER OBTAINED FROM THE CALCINATION OF COBALT SALTS
Teruichiro Kubo et al Jun. 1969 16 p refs Transl. into ENGLISH from Kogyo, Kagaku Zasshi (Tokyo), v. 67, no. 3, 1964 p 504–505
(NASA-TT-F-12203) Avail: CFSTI CSCL 07D

The fine structure of Co_3O_4 powder by X-ray diffraction and adsorption measurements is presented with a study to clarify the relation between the physico-chemical properties of Co_3O_4 powder and the thermal history and starting material when this oxide material is formed by the calcination of cobalt salts. Author

N69-30888# Harry Diamond Labs., Washington, D.C.
CONCENTRATION PROFILES OF TWO-STEP DIFFUSIONS OF BORON INTO SILICON
Edward P. Dudley (M.S. Thesis—Md. Univ.) Jan. 1969 44 p refs
(AD-684907; HDL-TR-1424) Avail: CFSTI CSCL 20/12

The concentration profiles of boron diffused into silicon were experimentally determined for two-step diffusions yielding surface concentrations near 10 to the 18th power/cu cm. The average diffusion coefficient of boron in silicon at 1150C was found. A flat portion of the experimental curves indicating a constant boron concentration near the silicon surface is explained on the basis of a segregation phenomenon at the silicon oxide-silicon interface. Author (TAB)

N69-30911# Aerospace Corp., El Segundo, Calif. Lab. Operations.
FRACTIONAL SOLIDIFICATION PHENOMENA
William R. Wilcox 30 Dec. 1968 28 p refs
(Contract F04701-68-C-0200)
(AD-685162; TR-0200(9250-03)-2; SAMSO-TR-69-64) Avail: CFSTI CSCL 7/4

Fractional solidification of organic compounds was observed under the microscope. A host of interesting phenomena were noted and are described here. For example, during melting of camphor-anthracene mixtures some of the anthracene crystallites actually grew in size. Inclusions of impurities and of gases in the solid moved toward the melt in some systems and further into the solid in others. Bubbles in the melt sometimes caused agitation of the melt and other times selective growth of a volatile component. Author (TAB)

N69-30915# Aerospace Corp., El Segundo, Calif. Lab. Operations.
TECHNIQUE FOR TRAPPING INTERMEDIATE SPECIES OF HIGH-TEMPERATURE REACTIONS
Eileen Cook and Barnard Siegel Nov. 1968 27 p refs
(Contract F04701-68-C-0200)
(AD-685160; TR-0200(4210-10)-6; SAMSO-TR-69-39) Avail: CFSTI CSCL 7/4

A technique is described that offers promise for use in high-temperature syntheses and in the study of mechanisms of high-temperature reactions. The electrical explosion of metal wires into surrounding gases initiates high-temperature reactions, but instead of confining the reactants to a reactor of fixed volume, temperature quenching is augmented by rapid adiabatic expansion of the heated gases. The explosion chamber that contains the initial reactants is separated from an expansion chamber that is either initially evacuated or filled with an inert gas. The two chambers are separated by a thin diaphragm, which is ruptured by the wire explosion. The technique leads to the trapping of intermediate species that would otherwise react further. The pyrolyses of methane and isobutane were used as model systems in this study. In the methane pyrolysis, the expansion technique leads to the isolation of ethane molecules, which are formed in the earliest stages of the mechanism of methane pyrolysis. In the isobutane pyrolysis, one also isolates ethane molecules formed in the earliest stages of the pyrolysis, and one tends to isolate the reaction C4H10 to CH4 + C3H6, which is an early step in the pyrolytic sequence. A later reaction, C3H6 to C2H2 + CH4, is effectively suppressed. Author (TAB)

N69-30917# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF THE THERMAL DECOMPOSITION PRODUCTS OF POLYTRIFLUOROCHLOROETHYLENE
Wei-Yuan Huang et al 12 Aug. 1968 9 p refs Transl. into ENGLISH from K'O Hsueh T'ung Pao (Peking), v. 17, no. 7, 1966 p 295–298
(AD-685056; FTD-HT-23-270-68) Avail: CFSTI CSCL 7/3

The decomposition of polytrifluorochloroethylene through high temperature and reduced pressure can yield hydrocarbons of lower molecular weight. The separation and structural identification of these compounds have seldom been reported. We applied

rectification and gas chromatographic methods to obtain 4,4-dichlorofluorobutene-1 from thermal decomposition product and to make structural identification. This paper reports the separation and structure determination of other components. The physical chemical constants of various thermal decomposition products and their derivatives are given. Author (TAB)

N69-30928# Ministry of Technology, London (England). TIL Reports Centre.
MECHANISM OF THE VAPOUR-PHASE NITRATION OF ALKANES BY NITROGEN PEROXIDE
V. Y. Shtern Feb. 1969 32 p refs Transl. into ENGLISH from Khim. Kinetika (USSR), 1966 p 286–322
(MINTECH-T-6031) Avail: CFSTI

The thermal nitration of methane and propane, a branching chain transformation of interest as a method for obtaining nitro products, was accomplished under static conditions in a glass vacuum environment. Reaction kinetics, based on the consumption of NO_2 and total pressure change, were investigated for mixtures over various pressure and temperature ranges. The results indicated that the nitration process for both alkanes varies with these conditions and can be classified accordingly as a slow reaction, a cold flame reaction, or an explosive (hot flame) reaction. The characteristics of each reaction, as well as the transition from one type to the other, are described in detail. A.C.R.

N69-30937# Frankford Arsenal, Philadelphia, Pa.
APPLICATION OF INFRARED SPECTROSCOPY TO THE ANALYSIS OF INORGANIC NITRATES. PHASE 1: SPECTRA OF INORGANIC NITRATES IN ACETONE AND THE USE OF SUCH SPECTRA IN ANALYTICAL CHEMISTRY
George Norwitz and David E. Chasan May 1968 46 p refs
(AD-673124; T68-7-1) Avail: CFSTI CSCL 7/4

A study was made of the spectra of soluble inorganic nitrates in acetone solution and the use of such spectra in analytical chemistry. The spectra of the soluble nitrates indicate the nitrate peaks in acetone can best be accommodated by a C2V point group assignment and the nitrate groups in the nitrate acetone system are essentially covalent in character. The effect of nitrate on the acetone peaks is briefly discussed. A study was made of the solubilities of anhydrous inorganic nitrates in acetone. The applications of the spectra of inorganic nitrates in acetone to analytical chemistry is discussed. A method is proposed for the determination of calcium in the presence of strontium or barium by treating the nitrates with acetone, filtering off the insoluble strontium or barium nitrates, and measuring the nitrate peak from the calcium nitrate at 824/cm. A similar procedure is also recommended for the determination of lithium in the presence of strontium and barium. Author (TAB)

N69-30949# Tyco Labs., Inc., Waltham, Mass.
STUDY OF THE NEW MATERIALS OF THE NICKEL BORIDE TYPE FOR USE AS FUEL CELL ANODES Final Scientific Report, 16 Aug. 1965–15 Aug. 1968
Raymond J. Jasinski, Gerhard L. Holleck, Jose Giner, and Edwin F. Rissman Aug. 1968 187 p refs
(Contract AF 19(628)-5549)
(AD-686470; AFCRL-68-0669) Avail: CFSTI CSCL 7/4

The main objective of this investigation was the characterization of nickel boride, nickel, and Raney nickel materials which are used as electrocatalysts for fuel cells. Preparation of Ni2B, Ni, Raney Ni. Ni2B was prepared by adding a solution of potassium borohydride to one of a nickel salt. The effect of the nickel salt, the pH of the solution, the rate of KBH4 addition, and the mode of drying (in air or under vacuum) were investigated. The decomposition of nickel formate yielded nickel blacks with surface areas, typically 50 to 70 sq.m./g. Raney nickel was prepared by decomposing a nickel aluminum alloy with potassium hydroxide. The resulting nickel black contained varying amounts of aluminum and alumina, depending on experimental conditions. The amounts of both substances were reduced by chemical and electrochemical leaching procedures. Typical areas were 60 to 100 sq.m./g. Author (TAB)

N69-30978# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
THE P–V–T SURFACE OF OXYGEN IN THE CRITICAL REGION; DENSITIES OF SATURATED LIQUID AND VAPOR
L. A. Weber [1969] 30 p refs Presented at the Cryog. Eng. Conf., Los Angeles, 16–18 Jun. 1969
(H-5) Avail: Issuing Activity

A description is given of an apparatus used to determine the detailed nature of the P–V–T surface of fluids in the critical region by means of dielectric measurements. Preliminary data are presented for the saturation densities of oxygen within one degree of the critical temperature. Author

N69-30989 Minnesota Univ., Minneapolis.
PHOTOEMISSION STUDIES OF THE GROWTH OF SODIUM ANTIMONIDE THIN FILMS
Dennis Glendon Fisher (Ph.D. Thesis) 1968 209 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 68-17674

Alkali antimonide photosurfaces are normally formed by reacting an Sb layer in an alkali metal vapor. In the present research, precise control was accomplished by utilizing the molecular beam approach whereby the constituent materials are evaporated from separate collimated sources. The films were grown in ultrahigh vacuum by depositing first the Sb layer, then successive Na layers. The reaction was allowed to proceed at room temperature. The average film composition was determined with a quartz crystal microbalance, which also served as the substrate. Photoemissive spectral yield and photoelectron energy distribution measurements were made following each Na deposition. During each deposition, the photoemissive yield at a fixed quantum energy was measured. Because of evaporation non-uniformities and sticking coefficient problems, it was found necessary to form the samples directly on the quartz crystal microbalance. Dissert. Abstr.

N69-31002# Massachusetts Univ., Amherst.
SCOPE AND MECHANISM OF THE ALKALINE DEGRADATION OF HALOPYRAZOLONES Final Report
Louis A. Carpino 31 Aug. 1968 5 p refs
(Grant DA-ARO(D)-31-124-G491)
(AD-676151) Avail: CFSTI CSCL 7/3

The work of this project began as a search for synthetic routes to cyclopropenones, a class of compounds of considerable theoretical interest which were unknown at the time the work was initiated. On the basis of analogy with earlier studies on non-benzenoid aromatic compounds it was thought that these ketones, although highly strained, would probably be capable of isolation in view of their predicted aromaticity. Although this method was not successful, it was possible to synthesize examples of the sulfonyl analogs which, in fact, represent the first examples of 3-ring heterocycles which are potentially aromatic because of possible D-orbital participation. Other important outcomes of the work involve development of a new synthesis of alpha, beta-unsaturated acids and new syntheses of important antipyrine-like compounds as well as mechanistic clarifications of these reactions. A brief outline of the most important results is presented. TAB

N69-31032# European Atomic Energy Community, Ispra (Italy).
MEASUREMENTS OF FOULING OF TERPHENYLS [MESURE DU POUVOIR ENCRASSANT DE TERPHENYLES]
G. L. Angelini, M. Hoepper, and F. Van Rutten Brussels Apr. 1969 24 p In FRENCH, ENGLISH summary
(EUR-4235.f) Avail: CFSTI

An equipment is described allowing reproducible measurements of fouling of terphenyls. It consists of an electrically heated horizontal tube on which fouling is deposited. A quantity of 150 g of terphenyl is used for each test. The measurements show that the deposits obtained depend on the impurities content of the terphenyl, on the diameter of the tube, on the temperature and on the mode of heating of the tube. Author

N69-31041# Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics.
THEORY OF OPTICAL ABSORPTION BY DIATOMIC MOLECULES EMBEDDED IN RARE GAS CRYSTALS
Phillip D. Mannheim and H. Friedmann (Israel Inst. of Tech.) May 1968 26 p refs
(Contract AF 61(052)-838)
(AD-675636; SR-6; AFCRL-68-0420) Avail: CFSTI CSCL 7/4

A new mechanism for the study of lattice dynamics is presented, rotation-translation coupling. With this mechanism the optically active rotational modes of diatomic molecules are coupled to the lattice vibrations of crystals in which the diatomic molecules are embedded. Using recently derived expressions which incorporate force constant changes in the vicinity of the defect we calculate and identify localized modes seen in the IR spectrum of HCl and HBr in rare gas crystals. Further we show how the lattice vibrations shift and broaden the rotational levels of the molecule. It is thought that this mechanism will prove useful in the study of the density of states of pure and impure crystals. Author (TAB)

N69-31042# Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Chemical Physics.
LINE MIXING BY COLLISIONS IN THE FAR INFRARED SPECTRUM OF AMMONIA
A. Lightman and A. Ben-Reuven Jun. 1968 13 p refs
(Contract AF 61(052)-838)
(AD-675638; SR-12; AFCRL-68-0422) Avail: CFSTI CSCL 7/4

The effect of mixing by collisions on overlapping lines in the far-infrared (rotation) spectrum of gaseous ammonia was studied. A collapse of the inversion doublets into a single line, similar to the collapse of the microwave inversion spectrum into a nonresonant spectrum, has been observed. The line shape has been analyzed using an adapted form of Ben-Reuven's theory and values of the damping and cross-relaxation parameters have been obtained for the rotational lines 3 to 4, 4 to 5, and 5 to 6. Author (TAB)

N69-31106# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFRARED ABSORPTION SPECTRUM OF THE B SUB 2 O SUB 2 MOLECULE
V. S. Nikitin et al 18 Dec. 1968 5 p refs Transl. into ENGLISH Vestn., Ser. 2: Khim. (Moscow), v. 21, no. 3, 1966 p 40–41
(AD-686228; FTD-HT-23-616-68) Avail: CFSTI CSCL 7/4

To check the reported data on the infrared emission band of 1890/cm and to find another band belonging to the deformation vibration Pi(i)(+), the infrared absorption spectrum of B2O2 vapor in the 230-4000/cm range was studied. TAB

N69-31114# Pennsalt Chemicals Corp., King of Prussia, Pa. Research and Development Dept.
RESEARCH IN THE BROAD FIELD OF SYNTHESIS AND CHARACTERIZATION OF INORGANIC COMPOUNDS AND MATERIALS Final Report, 15 Sep. 1958–14 Oct. 1968
B. Peter Block Mar. 1969 45 p refs
(Contract Nonr-2687(00))
(AD-684889) Avail: CFSTI CSCL 7/2

Work was performed toward the synthesis of polymers without carbon-carbon bonds in their backbones in areas ranging from completely inorganic systems to systems based on heterocyclic rings. Technical reports, publications, issued and allowed patents, oral presentations, and daughter contracts stemming from the fundamental program are tabulated, and an abstract is given for each technical report. The most interesting polymers discovered are the poly(metal phosphinates), a family of coordination polymers in which phosphinate anions serve as bridging groups between coordination centers. Author (TAB)

N69-31121# Mound Lab., Miamisburg, Ohio.
DETERMINATION OF LITHIUM HYDROXIDE BY CONTROLLED-CURRENT COULOMETRY
R. K. Gillette, K. L. Greenlee, D. R. Bohl, and D. E. Sellers 28 Mar. 1969 11 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1598) Avail: CFSTI

A procedure was developed for determination of lithium hydroxide with internal generation of hydrogen ions in an electrolyte solution. The procedure eliminated the preparation, standardization, and storage of standard solutions necessary for volumetric acid-base titrations and is readily adaptable to automation. An electronic, solid state, controlled-current coulometer was used to integrate the titration current. Samples containing 25 to 1000 μg/ml of lithium hydroxide were analyzed with an average standard deviation of ±0.6 μg. Results indicated that as little as 50 μg of lithium hydroxide are required to easily titrate solutions containing 25 to 1000 ppM lithium hydroxide. Good results were obtained with excellent reproducibility. Consequently, it should be possible to titrate solutions containing as low as 2 ppM lithium hydroxide with a 25-ml aliquot and an equal volume of electrolyte. Author (NSA)

N69-31130# General Technologies Corp., Reston, Va.
INFRARED SPECTROSCOPIC STUDY OF GAS-SOLID INTERACTIONS Final Report
James S. Burton Jan. 1969 111 p refs
(Contract PH-86-68-78)
(PB-182988) Avail: CFSTI CSCL 07D

In situ spectroscopic studies were conducted in a high temperature infrared cell up to 300°C. By measuring the integrated intensities of the sulfate absorption band of the reacted product, it was possible to calculate the rates at which limestone adsorbed sulfur dioxide from a simulated flue gas at 262°C. An activation energy of 11.8 kcal/mole was calculated for the adsorption process. A proposed design is presented for conducting the infrared studies in the 1600°–2000°F temperature region. Preliminary investigations were also conducted on the mechanism of dead-burning. Author (USGRDR)

N69-31147# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POLYCHLOROPRENE STRUCTURE STUDY. 2: A QUANTITATIVE INFRARED SPECTROSCOPIC METHOD FOR POLYCHLOROPRENE MICROSTRUCTURE INVESTIGATION
E. O. Azhandzhyan et al Nov. 1968 13 p refs Transl. into ENGLISH from Armyansk. Khim. Zh. (USSR), v. 20, no. 2, 1967 p 98–105
(AD-684835; FTD-HT-23-950-68) Avail: CFSTI CSCL 11/10

A quantitative ir spectroscopic determination was developed using low-mol.-wt. compds. (cis-4-chloro-4-octene, cis-5-chloro-5-decene, trans-4-chloro-4-octene, and 2-chloro-1-hexene) as model polychloroprene (I) units representing various modes of monomer unit addn. The concn. of representing various modes of monomer unit addn. The concn. of 1,4-cis, 1,4-trans, and 3,4-addn. modes

was determined using corresponding 1653, 1662, and 1636/cm max., respectively. The 1,2-addn. units were determined by the difference. The rubbers Nairit, Nairit KR, Nairit P, and Neoprene W prepd. with different regulators had 0.5% 1,4-cis; 12% 1,4-trans; 87% 3,4 and 0.5% 1,2 addn. units. Apparently the structure of the I chain prepd. by a free-radical mechanism is independent of the nature of the polymn. regulator. TAB

N69-31153# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SYNTHESIS OF CERTAIN HOMOLOGS OF ADAMANTANE FROM ADAMANTANE CARBOXYLIC-1 ACID

S. Landa et al 5 Dec. 1968 9 p refs Transl. into ENGLISH from Neftekhm. (Moscow), v. 8, no. 3, 1968 p 323–325
(AD-685029; FTD-HT-23-1007-68) Avail: CFSTI CSCL 7/3

The reaction of alkyl lithium with adamantane carboxylic-1 acid is used to synthesize ketones, which are then reduced by the Clemmensen method to produce homologs of adamantane. Also, carbinols obtained as by-products of the initial reactions are reduced by the Clemmensen method to produce a series of hydrocarbons. It is stated that the method outlined in the article gives higher yields of reaction products than previously published procedures. Also, the previously indescribed 1-tret-kutyl adamantane was synthesized. Author (TAB)

N69-31155# Engelhard Industries, Inc., East Newark, N.J. Research and Development Dept.

STUDY OF FISSION PRODUCT RHODIUM AS A POTENTIAL COMPONENT OF PLATINUM–RHODIUM ALLOY FOR USE IN PRODUCTION OF NITRIC ACID FROM AMMONIA

[1969] 9 p
(Contract AT(45-1)-2122)
(TID-25000) Avail: CFSTI

Eleven-year old fission product rhodium was converted at the Pacific Northwest Laboratories of Battelle Memorial Institute to 10% rhodium–90% platinum alloy in the form of a foil of 0.003-inch thickness. Greater than 98% of the radioactivity in the alloy was due to ^{102m}Rh. The only significant non-rhodium activity detected was ^{106}Ru. The dose rate from the gamma activity was 2mR at a source to detector distance of 5 cm from the sheet of alloy containing 4.2 grams of rhodium. Testing of the alloy at Engelhard Industries as catalyst in ammonia oxidation to produce nitric acid showed that the alloy should be suitable for this service. Radiochemical testing at Battelle after completion of the catalytic testing showed no significant change in activity. Author (NSA)

N69-31178# National Lead Co. of Ohio, Cincinnati.

SIMULTANEOUS DETERMINATION OF IRON AND SILICON IN URANIUM BY AUTO-ANALYSIS

J. R. Prall Feb. 1969 19 p refs
(Contract AT(30-1)-1156)
(NLCO-1030) Avail: CFSTI

Procedures were developed for the simultaneous automatic colorimetric determination of iron and silicon in uranium. This automated technique is especially suitable for analysis of large numbers of samples. The chromogenic reagent used for the determination of iron is 1, 10-phenanthroline. A molybdenum blue colorimetric procedure is used for the determination of silicon. The sample is dissolved without heating in a mixture of nitric and perchloric acids. After the reaction is complete, dilute hydrofluoric acid is added to completely dissolve the silicon. Flow diagrams are presented for the determination of each element. Author (NSA)

N69-31236# Sandia Corp., Albuquerque, N.Mex.

FUSED SALT MIXTURES: EUTECTIC COMPOSITIONS AND MELTING POINTS Bibliography, 1907–1968

Paul V. Clark and Crowell O. Dean 30 Dec. 1968 794 p refs Supersedes SC-R-65-930
(SC-R-68-1680; SC-R-65-930) Avail: CFSTI

Data on eutectic compositions and melting points of fused salt mixtures are presented in two complementary tables arranged by systems and by melting points. Over 5,000 references are given through December 30, 1968. Author (NSA)

N69-31244*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

TRIFUNCTIONAL ALCOHOL

Harold E. Marsh, Jr., and John J. Hutchison, inventors (to NASA) Filed 18 Apr. 1969 13 p
(Contract NAS7-100)
(NASA-Case-NPO-10714; US-Patent-Appl-SN-817569) Avail: CFSTI CSCL 07C

A new trifunctional alcohol, derived from trimer acid, and a method for preparing it are described. This trifunctional alcohol is normally in a liquid form, is readily soluble in various monomeric and polymeric materials, and has widely separated functional groups. The preparation consists of a synthesis involving the formation of either a methyl or ethyl ester of the trimer acid. The ester is then subjected to either of two processes to convert the ester groups to hydroxyl ones and form the desired alcohol. The first possible approach is the utilization of a catalytic high pressure hydrogenation. This provides about a 95% yield. A more preferred method comprises mixing the ester with lithium aluminum hydride to effect a reduction to the alcohol. This second method gives a quantitative yield of the desired end product. NASA

N69-31296# Oak Ridge National Lab., Tenn. Gaseous Diffusion Plant.

ENGINEERING DEVELOPMENT OF AN ABSORPTION PROCESS FOR THE CONCENTRATION AND COLLECTION OF KRYPTON AND XENON Progress Summary Report, Jan.–Jun. 1968

J. R. Merriman and J. H. Pashley 27 Mar. 1969 15 p refs
(Contract W-7405-eng-26)
(K-1770; PSR-3) Avail: CFSTI

A continuous absorption process for the separation of krypton and xenon from contaminated gas streams is being investigated in development studies. In this process, krypton and xenon are preferentially removed from an incoming gas stream by selective dissolution in a fluoro-carbon solvent, such as refrigerant-12. The liquid stream is then subjected to a series of fractionation operations which yield a product gas stream, rich in the noble gases, and an essentially pure solvent stream, for recycle. The major part of the program, i.e., pilot plant testing, is supplemented by conceptual plant design and optimization studies. Work on the assembly of a computer code package for use in the optimization studies was completed, with incorporation of sizing and cost estimating routines into the material balance program. Author (NSA)

N69-31340*# Hercules Research Center, Wilmington, Del.

A STUDY OF THE MECHANISM OF CHEMICAL REACTIVITY OF NITROGEN TETROXIDE WITH TITANIUM ALLOYS Final Report, 1 Jul. 1967–30 Aug. 1968

28 Feb. 1969 152 p refs
(Contract NAS8-21207)
(NASA-CR-102204; HRC-68-2) Avail: CFSTI CSCL 07A

The overall purpose of this program was to study the interactions between liquid dinitrogen tetroxide (N_2O_4) and 6A1 4V titanium alloy that lead to stress corrosion cracking by establishing the chemical composition of the minor constituents of reactive and nonreactive N_2O_4 systems. The specific objectives were: (1) to

develop a standard stress corrosion test capable of assessing the corrosive nature of various types of dinitrogen tetroxide (N_2O4) on 6Al 4V titanium alloy specimens; (2) to develop methods of analysis capable of detecting and determining significant differences between various types of N_2O_4; (3) to identify that constituent or component of N_2O4 which enhances or induces stress corrosion in 6Al 4V titanium alloy; and (4) to establish the possible presence of stress corrosion inhibitors in certain types of N_2O4. A satisfactory stress corrosion cracking test was developed and found to give extremely consistent results. Author

N69-31349# National Bureau of Standards, Boulder, Colo. Cryogenics Div.

NONANALYTIC VAPOR PRESSURE EQUATION WITH DATA FOR NITROGEN AND OXYGEN

Robert D. Goodwin 7 Aug. 1968 18 p refs Presented at the Cryog. Eng. Conf., Los Angeles, 16–18 Jun. 1969

(H-1) Avail: Issuing Activity

The specific heat of a two phase liquid–vapor system at constant volume apparently increases without limit at temperatures approaching the critical point, suggesting (via a thermodynamic relation) that the vapor pressure derivative d^2P/dT^2 may behave similarly. This nonanalytic behavior at the critical point is used in the present vapor pressure formula to gain simplicity and accuracy, as seen by use of data for nitrogen and oxygen. Author

N69-31364 Leeds Univ. (England). Dept. of Physical Chemistry.

CRITICAL EVALUATION OF RATE DATA FOR HOMOGENEOUS, GAS-PHASE REACTIONS OF INTEREST IN HIGH-TEMPERATURE SYSTEMS

D. L. Baulch, D. D. Drysdale, and A. C. Lloyd May 1968 30 p refs *Its* No. 1

Copyright. Avail: Issuing Activity

Some homogeneous gas phase reactions involving carbon monoxide have been evaluated. A separate section is devoted to each reaction, and the material includes thermodynamic data, the recommended value of rate constant, the Arrhenius plot of available data, a table of available data, discussions, and references. The thermodynamic data were obtained from two sources. The recommended value of a rate constant denotes the value considered most consistent with the available thermodynamic and experimental data. No preferred values were selected when reliable data were lacking. The arguments used to arrive at the recommended value are outlined in the discussion. Errors applying to the middle of the studied temperature range are quoted. In most cases the scatter of experimental points is such that no further improvement of errors seems justified, particularly because there is no clear-cut means of assigning weighting factors. K.W.

N69-31376# Pennsylvania Univ., Philadelphia. Dept. of Chemistry.

GEOMETRY AND VIBRATIONAL SPECTRA OF ALKALINE-EARTH DIHALIDES II: CALCIUM FLUORIDE, STRONTIUM FLUORIDE, AND BARIUM FLUORIDE

Vincent Calder, David E. Mann, K. S. Seshadri, Marcel Allavena, and David White 16 Apr 1969 30 p refs

(Contract N00014-67-A-0216)

(AD-686158; TR-3) Avail: CFSTI CSCL 7/4

The infrared spectra of 40CaF2, 44CaF2, 86SrF2, 88SrF2 and BaF2 trapped in solid krypton matrices at 20K are reported. From precise measurements of the shifts of the vibrational modes on isotopic substitution upper and lower limits for the apex angles of these molecules can be established. The mean values of the apex angle based on these limits are found to be 140 for CaF2, 108 for SrF2, and a reanalysis of the earlier data for MgF2 gives 150. For BaF2 the apex angle has been estimated at 100C. Using a valence force field a set of force constants have been obtained from the measured fundamental frequencies, as well as approximate values for the anharmonic corrections to these vibrational modes. The statistical entropies calculated from the vibrational frequencies and molecular geometries are in excellent agreement with the thermodynamic measurements. Author (TAB)

N69-31398# Air Force Systems Command, Edwards AFB, Calif. Rocket Propulsion Lab.

REACTION OF THE CHLORINE-FLUORINE INTERHALOGENS WITH HYDROGEN Phase Report, Sep. 1968–Jan. 1969

Frederic C. Jaye and Jay A. Blauer Apr. 1969 24 p refs

(AD-686429; AFRPL-TR-69-62) Avail: CFSTI CSCL 7/4

The reactions of ClF5, ClF3, and ClF with an excess of H2 were studied over the temperature range 351 to 525K in a gas-phase-flow reactor. The activation energy for each reaction is in each case approximately one half the interhalogen dissociation activation energy. The relationship between reactive stream separation and similar gas-phase reaction is shown. Calculated values are reported respectively for the H + ClF5, ClF3, and ClF exchange rate constants. Author (TAB)

N69-31447# British Petroleum Co., Ltd., Sunbury-on-Thames (England). Research Centre.

A LEED STUDY OF NICKEL: ELECTRON INTERACTION WITH CARBON MONOXIDE AND CARBON DIOXIDE ADSORBED ON THE (111) FACE, REPORT 2, PART 1 Summary Report

T. Edmonds 18 Apr. 1968 17 p refs

(Rept-10-151-Pt-1; Rept-2-Pt-1) Avail: CFSTI

The monitoring electron beam in the LEED system dissociates adsorbed carbon monoxide and carbon dioxide at the (111) surface of nickel. Patterns typical of carbon, oxygen, carbon monoxide, and carbon dioxide were observed. The adsorbed states of carbon monoxide, carbon dioxide, and oxygen were all weakly bound and electron desorption occurs as carbon monoxide molecules, carbon dioxide molecules, and probably as oxygen ions, respectively. Author

N69-31467*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.

PHOTOETCHING OF METAL-OXIDE LAYERS

Hans B. Bullinger, inventor (to NASA) Filed 13 Jun. 1969 12 p

(NASA-Case-ERC-10108; US-Patent-Appl-SN-833049) Avail: CFSTI CSCL 07D

This technique permits the selective removal of conductive metal oxide coatings from non-conductive substrates. Conventional photo-fabrication techniques are used to expose precisely defined regions of the metal oxide coating. A slurry of metallic elements and water is then applied to the exposed coating regions and an acid is added to the slurry to promote a reaction, thereby reducing the metal oxide to elemental metal. This reaction is terminated almost immediately by a water wash, thus allowing the reaction products to attack the elemental metal only superficially. The exposed elemental metal coating is removed by step-wise application of an etchant, typically an acid wash. The technique is thought to have application in the etching of very thin, usually transparent metal oxide layers of the type used in the fabrication of electroluminescent display devices. NASA

N69-31482# Coating and Chemical Lab., Aberdeen Proving Ground, Md.

RAPID ANALYSIS OF ANTIFREEZE USING GAS-LIQUID CHROMATOGRAPHY Final Report

George G. Esposito and Robert C. Jamison Apr. 1969 18 p refs
(AD-686289; CCL-263) Avail: CFSTI CSCL 11/7

Glycols and glycol ethers are used as freezing point depressants in permanent type antifreeze formulations, the type and amount being dictated by environmental conditions. The formulation and maintenance of a suitable antifreeze for automotive application, imposes the need for test methods that are capable of determining the composition of concentrates as well as used antifreeze. The report describes an analytical procedure which is consonant for the identification and determination of glycols and ether-alcohols as they occur in used and unused antifreezes, with no interference from water, inhibitors, and other additives. The various components are separated using gas-liquid chromatography; qualitative and quantitative information is obtained by relating the position and magnitude of each peak to that of an internal standard.
Author (TAB)

N69-31484# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
DIFFUSION OF RESONANCE EXCITATION THROUGH A ONE-DIMENSIONAL GAS
Edward M. D'Arcy (M.S. Thesis--Tex. Univ., El Paso) Mar. 1969 43 p refs
(AD-686286; ECOM-5240) Avail: CFSTI CSCL 7/4

The equation to express the rate at which resonance excitation diffuses through a one-dimensional gas is derived. A numerical algorithm for this equation is made and numerical results are displayed in graphic form to show the relative effects of two terms - the diffusion term and the translational term. In addition, figures are presented to show the effect of translational motion on the spectral distribution of escaping radiation and how this distribution of escaping radiation and how this distribution changes with time.
Author (TAB)

N69-31491# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
CORROSION OF STAINLESS STEEL IN SOLUTIONS OF CERIUM (IV)-NITRIC ACID
R. E. Lerch 1 May 1968 12 p refs
(Contract AT(45-1)-1830)
(BNWL-CC-1646) Avail: CFSTI

Type 304 stainless steel was found to corrode quite rapidly in nitric acid solutions containing cerium (IV) nitrate. Dissolution rates of the stainless steel increased with increases in total cerium concentration, nitric acid concentration, rate of cerium (IV) generation, and temperature. The maximum dissolution rate was 3714 mg/cm^2/month (~2.26 in./yr) for dissolution of stainless steel in 2.0M nitric acid ~0.10M cerium (IV) at 50°C. (The normal dissolution rate for 304 stainless steel in 2M nitric acid at 50°C is <0.17 mg/cm^2/month.) The rate of 3714 mg/cm^2/month is sufficiently high to rule out stainless steel as a material of construction for use with cerium (IV)--nitric acid solutions unless a corrosion inhibitor can be found; however, the rate is probably too low to make the process attractive for fuel decladding.
Author (NSA)

N69-31512# Nebraska Univ., Lincoln. Dept. of Chemistry.
REACTIONS OF HALOGEN ATOMS ACTIVATED BY NUCLEAR PROCESSES WITH ORGANIC MEDIA AT 77 DEG AND 298 DEG K
Richard Merle Lambrecht (Ph.D. Thesis) 31 Jan. 1969 173 p refs
(Contract AT(11-1)-1617)
(COO-1617-14) Avail: CFSTI

The chemical reactions initiated by the ^{130m}I(IT)^{130}I and ^{82m}Br (IT)^{82}Br processes were investigated and compared with those induced by the ^{128}I(n,γ) ^{130}I + ^{130m}I, ^{127}I(n,γ)^{128}I, ^{37}Cl(n,γ)^{38}Cl, and the ^{81}Br(n,γ)^{82}Br + ^{82m}Br nuclear transformations. The organic yields of ^{130}I + ^{130m}I and ^{128}I activated by radiative neutron capture were compared to those of ^{130}I activated by isomeric transition in several liquid hydrocarbons ranging from n-pentane to n-nonane. The organic yields of (n,γ) activated ^{130m}I + ^{130}I are consistently lower than the (IT) induced organic yields of ^{130}I and (n,γ) activated ^{128}I. Radiogas chromatography analysis indicated the similarity of products but differences in abundance of the relative product yields of ^{128}I, ^{130}I, and ^{82}Br. The (n,γ) and (IT) activated reactions of bromine were studied in various liquid hydrocarbons ranging from pentane to tridecane. The total organic yields of (n,γ) activated ^{80m}Br were lower than the (IT) organic yields of ^{82}Br at all Br_2 concentrations studied. The organic yields were found to vary with the chain length and the target molecule structure.
NSA

N69-31515# Technische Hogeschool, Einhoven (Netherlands).
THE OXIDATION OF GLUCOSE
Hendricus Gijsbertus Johannes De Wilt (Ph.D. Thesis) 3 Jun. 1969 145 p refs
Avail: CFSTI

The kinetics of the platinum catalyzed oxidation of glucose is discussed. The mechanism and the kinetics of the parallel existing, noncatalytic, homogeneous oxidation are studied in order to achieve basic information on the behavior of hexoses in aqueous alkaline solutions. An analytical system is developed based on gas--liquid chromatography and displacement electrophoresis in capillary tubes. Some different types oc catalysts and supports are discussed. A comparison between a continuous stirred tank reactor and a trickle bed system is given.
Author

N69-31522# Battelle Inst., Frankfurt am Main (West Germany).
SUBSTITUTED CYCLOOLEFINS AND PARTIALLY HYDROGENATED BIPHENYLS
S. Sandroni (Euratom), C. Beaudet (SERAI), and G. Juppe (Euratom) Brussels Euratom 1969 38 p refs
(EURATOM-295-61-10-ORGC)
(EUR-4215) Avail: AEC Depository Libraries

For a better understanding of the pyrolytic and radiolytic behavior of partially hydrogenated polyphenyls larger amounts of high purity 1-phenylcyclohexene, 3-phenylcyclohexene, 4-phenylcyclohexene, 1-, 3- and 4-methylcyclohexene, 1-methylcyclopentene, 1-methylcycloheptene, 1, 3- and 1,4-cyclohexadienes were synthesized and the compounds characterized by their ultraviolet, infrared, Raman, and nuclear magnetic resonance absorptions. From spectral correlations a 2,5-phenylcyclohexadiene structure was assigned to the Birch reduction product of biphenyl with sodium.
Author (NSA)

N69-31536# Los Alamos Scientific Lab., N.Mex.
EQUATION OF STATE FOR SHOCKED POLYURETHANE FOAM
Charles L. Mader and William J. Carter 22 Nov. 1968 51 p refs
(Contract W-7405-eng-36)
(LA-4059) Avail: CFSTI

The experimentally observed behavior of systems of high explosives, low density (0.5- and 0.3-g/cc) polyurethane foam, and metals can be numerically reproduced if the foam is assumed to decompose and the decomposition products are described by a BKW equation of state.
Author (NSA)

N69-31539# Institute For Defense Analyses, Arlington, Va. Science and Technology Div.
DE-EXCITATION OF ELECTRONICALLY EXCITED SODIUM BY NITROGEN AND SOME OTHER DIATOMIC MOLECULES
E. Bauer, E. R. Fisher (Wayne State Univ.), and F. R. Gilmore (RAND Corp., Santa Monica, Calif.) Mar. 1969 92 p refs
(Contract DAHC15-67-C-0011)
(AD-684794; RP-P-471) Avail: CFSTI CSCL 7/4

A semiquantitative calculation was made of the cross sections for the de-excitation of sodium by nitrogen as a function of initial kinetic energy and final vibrational quantum number v(f). The large observed total cross section, which is of gas kinetic order, can be explained by an intermediate ionic state, involving Na(+) and N2(-)(v = v(-)). This state is unstable at infinite separation of the atom and molecule; but, because of the Coulomb attraction, it becomes stable at distances below approximately 3A. As a result of the vibrational structure of N2(-)(v(-)) and of the final state, N2(v(f)), a classical diffusion is considered of the probability amplitudes through a two-dimensional network of potential-energy curves which have the vibrational structure, v(-) and v(f), and the electronic state as parameters. The calculations were made for a variety of incident energies and impact parameters and assumed values of the polarizability of the Na(+) + N2(-) complex. Results are also presented regarding cross sections for the quenching of Na(3 doublet P) by CO and O2 and of Na(4 doublet P) by N2. All the results have the same general character: The total cross sections are of gas kinetic order, and depend only weakly on kinetic energy. Author (TAB)

N69-31624*# California Inst. of Tech., Pasadena. Firestone Flight Sciences Lab.
RESPONSE TO UNIAXIAL TENSION IN THE SWOLLEN STATE AND SOME NETWORK CHARACTERISTICS OF VARIOUS COMPOSITIONS OF SOLITHANE 113
H. K. Mueller Jun. 1969 14 p refs
(Grant NGL-05-002-005; Contract F04611-67-C-0057)
(NASA-CR-103294; GALCIT-SM-69-6; GALCIT-120) Avail: CFSTI CSCL 07D

The results of uniaxial tension test of four different Solithane compositions swollen in Toluene are presented in the form of Mooney–Rivlin plots. All compositions behaved essentially neo-Hookean up to failure. The number of elastically effective network chains was calculated from this data. The interaction parameter μ could then be obtained through ν_e and equilibrium swelling data. The results show that the interaction parameter depends on the composition of Solithane 113 and cannot be considered a constant. Author

N69-31637# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Heisse Chemie.
KINETICS OF EXTRACTION OF METALS WITH ORGANOPHOSPHORUS COMPOUNDS
F. Baumgaertner and L. Finsterwalder Sep. 1968 18 p refs
(KFK-839) Avail: AEC Depository Libraries

The extraction mechanism is discussed with regard to the chemical steps leading to the equilibrium state. Mass transfer studies were made on the extraction of uranyl nitrate and plutonium nitrate from an aqueous phase into a hydrogen solution of TBP. NSA

N69-31648# Wisconsin Univ., Madison. Mathematics Research Center.
CONCENTRATED POLYMER SOLUTIONS
A. S. Lodge Oct. 1968 20 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-686137; MRC-TSR-944) Avail: CFSTI CSCL 7/4

It is shown that the Rouse/Zimm bead-spring model (for the case of one spring per molecule and zero bead-bead hydrodynamic interaction) and the network model (for the case in which all junction loss probabilities are equal and constant) yield constitutive equations which are of the same form and differ only in the interpretations given to constant coefficients; an explanation is given. Author (TAB)

N69-31709# International Atomic Energy Agency, Vienna (Austria).
QUICK METHODS FOR RADIOCHEMICAL ANALYSIS
Feb. 1969 63 p *Its* Ser. No. 95
(STI/DOC-10/95) Avail: AEC Depository Libraries; IAEA $2.00

Methods for determining ^{137}Cs in water, milk, and urine; ^{131}I in waste waters, milk, rainwater, and urine; ^{32}P in urine; Pu in waste water, urine, and various matrices; ^{89}Sr and ^{90}Sr in water and urine; beta activity in water; and alpha activity in urine are presented. NSA

N69-31739# Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Chemical Physics.
PRESSURE BROADENING AND SHIFT OF METHANE PERTURBED BY NOBLE GASES
Hanna Goldring, Abraham Szoeke, Ehud Zamir, and Abraham Ben-Reuven
May 1968 18 p refs
(Contract AF 61(052)-838)
(AD-675873; AFCRL-68-0421; SR-11) Avail: CFSTI CSCL 7/4

High-resolution tuned-laser spectroscopy was used to measure pressure broadening and shift of the methane 2947.907 reciprocal cm line perturbed by noble gases. The galatry line shape was found best suitable for determining the line width. It was found necessary to modify Foley's phase-shift theory by adding a 'hard-core' term to the collision cross sections in order to explain the experimental results. (TAB)

N69-31800# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ORIENTED COMPOSITES BY SOLIDIFICATION OF OFF-EUTECTIC MIXTURES CONTAINING A STRONG FIBER-FORMER Technical Report, Feb.–Aug. 1968
William R. Wilcox and James R. Teviotdale 21 Jan. 1969 12 p refs
(Contract F04701-68-C-0200)
(AD-685714; TR-0200(9250-03)-3; SAMSO-TR-69-83) Avail: CFSTI CSCL 7/4

The purpose of the present work was to see just how drastic freezing conditions could be to obtain an oriented composite when one component was a strong fiber-former. An organic system was chosen for the experiments to permit observation of the freezing interface under the microscope. The system camphor-N, N-dimethyl p-nitroaniline was found to exhibit the desired characteristics. Camphor solidifies in a non-faceted manner, whereas the aniline produces needles or rods. TAB

07 COMMUNICATIONS

Includes communications equipment and techniques, noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N69-30423# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
SPECIFICATIONS FOR ELECTRONIC IMAGE-FORMING DEVICES

Lucien M. Biberman. Mar. 1969 39 p refs
(Contract DAHC15-67-C-0011)
(AD-684793; RP-P-467; IDA/HQ-68-9532) Avail: CFSTI CSCL 17/2

Evaluation and specification of image quality for electro-optical systems are difficult because of the convolution of such factors as modulation transfer function (MTF), which is defined so as to exclude noise, and the noise power spectra. The tradeoff between MTF and noise power spectra has not been established nor has it been considered to have specific, different requirements for various different viewing tasks. Television specifications for example are quite adequate for entertainment purposes but are not adequate for ensuring performance for more demanding visual tasks. This paper discusses specifications required for image-forming devices. In addition, a concept developed by the late T. Brian-Smith has been extended and is put forward as a means to permit evaluation of the combined MTF-NOISE degradation of image quality. Author (TAB)

N69-30443# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE OPTIMUM SHAPE OF NONCOHERENT RADAR PULSE SIGNALS
V. S. Trusov 3 Jul. 1968 8 p refs Transl. into ENGLISH from Russian Report Presented at 22nd All Union Sci. Session dedicated to Day Radio, 1966
(AD-685065; FTD-HT-23-314-68) Avail: CFSTI CSCL 17/9

The report presents a method for deriving the optimum shape of radar pulses which minimizes the deviations in the estimate of target distance and velocity. It is assumed that the S/N is sufficiently high and that the radar system operates in a narrow band of frequencies processing the information by the maximum likelihood method. Families of curves calculated on a digital computer supply information on the optimum pulse shapes for best target distance estimates and target velocity estimates. The pulses are symmetric for both cases, but their shapes differ. Curves showing the advantage of these pulses over rectangular pulses are also presented. TAB

N69-30581# Boeing Co., Seattle, Wash. Office of International Operations.
THE PREDETECTION MAGNETIC TAPE RECORDING OF AM/FM AND FM/FM TELEMETRY SIGNALS
H. Bothe Apr. 1969 28 p Transl. into ENGLISH from German Report DLR-FB-68-34
(J-85; DLR-FB-68-34) Avail: CFSTI

The predetection magnetic tape recording of AM/FM and FM/FM telemetry signals is investigated. Theoretical evaluations of noise voltages and test measurements on six magnetic tape recorders of different manufacturing companies are described. The estimations and test results are used to determine the suitability of the equipment for storing telemetry signals on magnetic tape. Simple test procedures are indicated. Author

N69-30886*# Kansas Univ., Lawrence. Center for Research in Engineering Science.
APPLICATION OF COLOR-COMBINED MULTIPLE POLARIZATION RADAR IMAGES TO GEOSCIENCE PROBLEMS
David S. Simonett [1968] 5 p refs
(Contract NSR-17-004-003)
(NASA-CR-101759; CRES-61-27) Avail: CFSTI CSCL 17I

An image discrimination enhancement combination and sampling (IDECS) system was developed to work with multifrequency, polypolarization radar images. Described is the operation of the system in producing color combined radar images on a color television set, in producing differentiated and other modes of image enhancement, and in deriving probability density functions from the images. Examples are given of the way in which color combined multiple polarization radar images improve discrimination of lithologies and crops over that of a single radar image. A number of future modifications intended for improved texture discrimination, and data space sampling are described briefly. Author

N69-30755*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRIMARY CHEMICAL, METALLURGICAL, AND ELECTRO-OPTICAL TECHNIQUES FOR EVALUATING MAGNETIC TAPES
Aaron Fisher, John Grimsley, Thomas Sciacca, and Charles Staugaitis Jun. 1969 54 p refs
(NASA-TM-X-63595; X-735-69-230) Avail: CFSTI CSCL 14C

Spacecraft recorders and tape systems must be very reliable and long lived because they are direct communication links between the ground observer and experiments on unmanned spacecraft. A recent survey of the recorder and tape industry indicates that many problems, including tape-head sticking, have not been solved. A program was set up using various physico-chemico-metallurgical techniques to search for those criteria that could be especially significant for differentiating between tapes. The attempted methods and the analytical success of each are reviewed. Author

N69-30883# Michigan Univ., Ann Arbor. Radiation Lab.
INVERSE SCATTERING INVESTIGATION Final Report, 3 Mar. 1967–3 Mar. 1968
Vaughan H. Weston and Wolfgang M. Boerner Bedford, Mass. ESD Apr. 1968 81 p refs
(Contract F19628-67-C-0190)
(AD-675640; Rept-8579-F; ESD-TR-68-215) Avail: CFSTI CSCL 20/14

A brief review of the salient features of the theoretical investigation of the C.W. Bistatic inverse scattering problem is presented. The effect of changing the origin of the coordinate system upon the convergent properties etc., of the spherical vector wave function representation of the near scattered field and the surface loci ex $E^s = o$, is discussed. It is pointed out that a great deal of analysis remains to be done in this area. The determination of the surface of the scattering body from knowledge of the local total electric field is given. Emphasis is placed upon the generalization of the condition ex $E^s = o$ as applied to perfectly conducting bodies, to scattering surfaces characterized by the impedance boundary condition. Properties of the matrix inversion associated with the determination of the expansion coefficients from far field data are discussed. Some numerical results are presented, and restrictions upon the choice of aspect angles are deduced. Author (TAB)

N69-30890# Norges Tekniske Hogskole, Trondheim. Akustisk Laboratorium.
TWENTY-FOUR CHANNEL DISPLAY UNIT [24 KANALS DISPLAYENHET]
S. Feogner, E. Sorli, A. Krokstao, and G. Stette Oct. 1967 28 p In NORWEGIAN
(ILEA-141) Avail: CFSTI

The display unit is designed for the simultaneous presentation of multiple time-varying signals. The unit is used in connection with a television screen, and the adaptation requires only minor modifications. Block schematics of the unit and its components are presented. Major components of the unit are the counting circuits with the decoding network, the sensor gates with a pulse limiter and output circuitry, the logarithmic network and a dc amplifier, a pulse width modulator, and the control circuitry consisting of synchronous generators for lines and pictures. Transl. by K.W.

N69-30907# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
THE ACCURACY OF LINEAR AUTOMATIC TRACKING SYSTEMS
P. A. Barankov Feb. 1969 19 p refs Transl. into ENGLISH from Vestn Mosk. Univ., Ser. 1: Mat. i Mekhan (Moscow), No. 2, 1968 p 63–71
(Contract NOw-62-0604)
(AD-686460; APL-CLB-3-T-578) Avail: CFSTI CSCL 17/9

Linear, dual-channal, symmetrical tracking systems with conical scan are considered under random noise conditions. System accuracy is examined with due regard for the effect of the periodic component of the input signal on the behavior of the closed loop. Using the spectral theory of stationary random processes, the root-mean-square tracking error is computed as a function of the system parameters and real time. TAB

N69-30929# National Inst. for Telecommunications Research, Hartebeesthoek (South Africa). Council for Scientific and Industrial Research.
COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH Annual Report 1967–1968
1968 19 p refs
(CSIR-TEL-71) Avail: CFSTI

The status of continuing long-range research and development projects in the following areas is reported: (1) study of radio wave propagation and associated phenomena; (2) advanced radio techniques and development of specialized equipment and systems; and (3) use of radio as an essential part of other research programs, particularly its role in the Deep Space Instrumentation Facility and the Satellite Tracking and Data Acquisition Station. Propagation studies include ionospheric soundings at vertical incidence; forecasts of optimum traffic frequencies; construction of an ionosonde; measurement of radio noise levels under 30 MHz; and investigations of lighting phenomena and the generation of radar echoes from precipitation. Advanced research is in progress on the Tellurometer system of distance measurement; distance measurement techniques using infrared beams, and modulation by pseudo-noise codes. A.C.R.

N69-30942# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
ELECTROMAGNETIC INTERFERENCE MEASUREMENT METHODOLOGY, COMMUNICATION EQUIPMENT Quarterly Report, 1 Aug.–31 Oct. 1968
William R. Free and Charles W. Stuckey Fort Monmouth, N.J. Ecom Mar. 1969 39 p refs
(Contract DAAB07-68-C-0189)
(AD-685045; GIT-A-1075-3; QR-3; ECOM-0189-3) Avail: CFSTI CSCL 17/2

The purpose of this program is to conduct theoretical and experimental investigations directed toward the development of improved test setups, procedures and equipment for the measurement of radiated emission and susceptibility characteristics of military communication-electronic equipment. The three primary objectives of the program are (1) the development of techniques for measuring radiated interference and susceptibility characteristics in shielded enclosures over the frequency range from 20 to 200 MHz, (2) the development of broadband hooded antennas which minimize the narrowing effect of the hood on the antenna field pattern and (3) an investigation to determine the availability of broadband, balanced probe antennas suitable for radiated emission and susceptibility measurements in shielded enclosures over the frequency range from 14 kHz to 200 MHz. Author (TAB)

N69-30987# Weapons Research Establishment, Adelaide (Australia).
THE WRESAT TELEMETRY SYSTEM
L. L. Anderson Jan. 1969 44 p refs
(WRE-TN-P-95) Avail: CFSTI

Australia's first satellite was launched from Woomera on 29 November 1967. This paper describes the parameters selected, the telemetry carried in the satellite, and the telemetry ground receiving station at Woomera. Some details are included of the tests carried out at Orroral Valley to ensure compatibility with the worldwide STADAN stations. The results achieved and the effectiveness of the telemetry system are discussed. Author

N69-31071# RAND Corp., Santa Monica, Calif.
THE PROPAGATION OF ELF WAVES UNDER NORMAL AND NATURALLY DISTURBED CONDITIONS
E. C. Field Mar. 1969 42 p refs
(Contract DAHC15-67-C-0141; ARPA Order 189-1)
(AD-686372; RM-5922-ARPA) Avail: CFSTI CSCL 17/2

Theoretical analysis of the propagation of electromagnetic waves in the frequency range 30 Hz to 1000 Hz in the earth-ionosphere waveguide. Full wave methods incorporating the vertical inhomogeneity of the ionosphere are used. The model ionospheres, which correspond to both normal and disturbed (polar cap absorption - PCA) conditions, are chosen to illustrate the sensitivity of the propagation to various ionospheric properties. Attenuation constants and phase velocities pertinent to various models are calculated. In addition, detailed calculations of the height dependences of the electromagnetic fields and Joule heating are presented. Resulting conclusions are drawn as to which ionospheric properties and altitude regions most strongly influence the mode structure in the various cases. For example, it is concluded that ions always dominate ELF propagation under moderately disturbed (PCA) conditions, but under ambient conditions, ions are an important factor only for frequencies lower than a few hundred Hz. Author (TAB)

N69-31079# Weapons Research Establishment, Adelaide (Australia).
TYPE 465 TELEMETRY RECEIVING AND RECORDING EQUIPMENT AT THE WOOMERA RANGE
J. S. Bell Feb. 1969 54 p refs
(WRE-TN-TSD-35) Avail: CFSTI

The type 465 telemetry system installed at the Woomera Range is a PAM/FM/AM system operating in the 432.5 to 490 MH_2 band. The transmitted data are contained in a frequency modulated subcarrier of 130 to 160 kH_z. This document provides a review of the principal features of the system and a detailed description of the system arrangement and modes of operation. Author

N69-31098# Army Electronics Command, Fort Monmouth, N.J.
AN IMPULSE TECHNIQUE FOR THE GENERATION OF NARROW RF PULSES
Michael A. Fanuele Aug. 1968 25 p refs
(AD-684917; ECOM-3008) Avail: CFSTI CSCL 17/9

The report summarizes an impulse technique for the generation of nanosecond pulses in the microwave region. Discussed are the impulse responses of ideal low and bandpass filters, as well as the response of an ideal high pass filter to a band limited impulse and their relationship to each other and to the problem. Also discussed is a technique for the generation of a very narrow pulse to approximate an impulse. Impressing this narrow pulse onto the input of a bandpass filter (1-2 GHz traveling wave tube) resulted in the generation of two nanosecond RF pulses at a peak power of 0.5 watt. Author (TAB)

N69-31209# Lincoln Lab., Mass. Inst. of Tech., Lexington.
BAYES AMBIGUITY FUNCTIONS: SOME SIMPLE APPLICATIONS TO RESOLUTION AND RADAR COUNTERMEASURES
David Middleton 13 Feb. 1969 66 p refs
(Contract AF 19(628)-5167)
(AD-686420; TN-1969-16; ESD-TR-69-10) Avail: CFSTI CSCL 17/9

Bayes ambiguity functions are defined as an important parameter governing the performance of optimum (i.e., Bayes or minimum average risk) systems. Bayes ambiguity functions are generalizations of the classical ambiguity functions of Woodward and are specifically derived from an appropriate decision process. It is shown here that it is the real part of the ambiguity function that is significant, rather than its modulus. Optimum target resolution is formulated as a detection problem involving the two hypothesis states H sub o: unresolved signals versus H sub 1: resolved signals, and general conditions for the qualitative utility of the ambiguity functions are discussed. These latter are: additive gaussian noise and threshold operation; otherwise the ambiguity function is an inadequate description of system performance. The analysis is extended to a number of situations involving interfering signals, such as electronic countermeasures (ECM) and is illustrated with simple examples showing quantitiatively, as well as qualitatively, the typical roles played by the Bayes ambiguity function in a variety of ECM applications. It is emphasized that one must also consider the probability of correct and incorrect decisions, in conjunction with the properties of the ambiguity functions, to achieve a reliable measure of expected performance. Author (TAB)

N69-31221# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
COHERENCY CRITERION FOR THE BINARY SYMMETRIC CHANNEL
Joseph M. Aein Mar. 1969 49 p refs
(Contract DAHC15-67-C-0011)
(AD-684792; RP-P-463) Avail: CFSTI CSCL 9/4

For the purpose of communication system planning, predictions of system performance based upon models of an ideal coherent channel are extensively used. Previous work has demonstrated the deleterious effects of RF phase error on channel performance by machine computation of an integral derived by statistically averaging over the phase error. The required receiver performance in deriving the RF phase for detecting binary coherent signals is examined and a criterion is generated which, when satisfied, allows the use of the familiar performance formula derived from the idealized coherent channel mode. The criterion is obtained without resorting to machine computation. The Tikhonov probability distribution for the RF reference phase error is used. Some implications of the criterion for low capacity coherent channels are exhibited. In particular, the advantages of coding to reduce the energy to noise density ratio are examined. In this regard, carrier-present and suppressed-carrier coherent channels are contrasted. Author (TAB)

N69-31453# Signals Research and Development Establishment, Christchurch (England).
THE RATING OF VARIABLE SLOPE DELTA AND DELTA SIGMA MODULATING SYSTEMS IN A FREE CONVERSATION TEST USING THE REFERENCE SPEECH LINK
L. S. Butler Oct. 1968 26 p refs
(AD-686339; SRDE-68024) Avail: CFSTI CSCL 17/2

This report describes a free conversation opinion test designed on a statistical basis to assess the performance of delta sigma and variable slope delta modulating equipments. Tests were made at digit rates of 12 and 19.2 Kb/s and with randomly distributed digital errors at constant density of 5 and 10% introduced into the digit stream. The delta sigma equipments in each case were rated higher on the sensitivity-noise scale than the VSD equipments under comparable conditions. Author (TAB)

N69-31483# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
A DIMENSIONAL ANALYSIS OF THE ERRORS OF ATMOSPHERIC SOUND RANGING
Robert P. Lee Mar. 1969 77 p refs
(AD-686287; ECOM-5236) Avail: CFSTI CSCL 17/1

This report is based on a probabilistic model for single-array sound ranging in a nonhomogeneous atmosphere. The magnitude of the radial acoustic source location error as a function of various error sources and array dimension is shown. From the set of error contour curves given for the six-microphone line array in dimensionless format, it is shown that the radial acoustic source location error at any given point in the ground plane can be estimated for any size array. All phases are illustrated with the results of sample calculations. Author (TAB)

N69-31561# Federal Aviation Administration, Atlantic City, N.J. National Aviation Facilities Experimental Center.
EVALUATION OF DIGITAL CHECK CHARACTER GENERATORS USED IN TELETYPEWRITERS Final Report
Charles G. Santora Jul. 1968 42 p refs
(AD-686382; NA-68-23) Avail: CFSTI CSCL 17/2

This report deals with two preproduction digital check character generator (DCCG) models installed in the teletypewriters of the NAS En Route Stage A System Support Facility at the National Aviation Facilities Experimental Center (NAFEC). The purpose of this effort was to determine compliance with the applicable specification and provide technical information on installation, operation, test procedures, and measured characteristics of these models and the required changes to be made in the production units. Author (TAB)

N69-31640# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INFORMATIONAL PRINCIPLES OF THE TRANSMISSION OF MESSAGES
N. I. Klyuev Dec. 1968 327 p refs Transl. into ENGLISH of Inform. Osnovy Peredachi Soobshch. (Moscow), 1966 p 1–360
(AD-686380; FTD-HT-23-1642-67) Avail: CFSTI CSCL 9/4

The book is concerned with the application of information theory to the design of new systems for collecting, transmitting, and transforming information. It may also be of use in evaluating existing systems. The material is presented systematically in a format easily accessible for beginners. Included are many design methods, theoretical generalizations, and results which are of interest to information theory specialists. General statements on information theory are supplemented by a number of new concepts applicable to practical problems. Methods of coordinating terminal equipment to communication channels are described. Problems of speed of information transfer over binary communication channels carrying regular and fluctuating signals are discussed. A new criterion of information detection that establishes a link between Kotelnikovs criterion and the basic relationships of information theory is introduced. It is shown that matched filters may be considered optimal in information transmission applications. Structural problems of certain matched filters are discussed. TAB

N69-31651*# ADCOM, Inc., Cambridge, Mass.
STUDIES AND ANALYSES OF AUTOMATIC COMMAND CONTROL COMMUNICATIONS AND APPLICATIONS OF TIME REFERENCE SYSTEMS FOR AUTOMATIC FLIGHT MANAGEMENT Final Report

H. C. Salwen, S. M. Sussman, and C. H. Boardman 26 Jan. 1969 123 p refs
(Contract NAS12-2014)
(NASA-CR-103305; G-140F) Avail: CFSTI CSCL 17B

Investigated is the application of data links and time reference systems in automatic navigation and flight management. Reviewed are the flow of information and signals on the various links and from the aircraft and a future unified system is projected that incorporates satellite communication/navigation over unpopulated areas, satellite navigation and direct or satellite communication over populated regions, direct radiating landing aids, and air-to-air direct communication for special purposes. Several combined communication/ranging modulation schemes are described and analyzed and trade-offs are presented for each configuration. It is established that pseudorandom ranging codes are severely limited in data capacity. Preliminary evaluation of time reference systems shows that the application of these systems to aircraft communication problems is only productive if the position of the aircraft is known with an accuracy commensurate with the time reference accuracy. For this reason, the characterization of errors in position determinations associated with such techniques as loran-C, Omega, and DME/DME is discussed. It is found that a state-of-the-art quartz standard source would meet the timing accuracy requirements if it is calibrated at 1 hour intervals and that a cesium standard would have to be recalibrated daily. Author

N69-31652# Lincoln Lab., Mass. Inst. of Tech., Lexington.
LINCOLN EXPERIMENTAL SATELLITE-5 (LES-5), TRANSPONDER PERFORMANCE IN ORBIT
W. W. Ward and B. F. Nichols 1 Nov. 1968 68 p refs
(Contract AF 19(628)-5167)
(AD-686421; TN-1968-18) Avail: CFSTI CSCL 17/2.1

A review and analysis of the first in-orbit year of transponder operation aboard the fifth experimental satellite built by Lincoln Laboratory and launched 1 July 1967. The measured performance of the satellites UHF transponder as a communications repeater is discussed as are its beacon and telemetry systems. Author (TAB)

N69-31692# Aerospace Corp., El Segundo, Calif. Lab. Operations.
OUTPUT SIGNAL-TO-NOISE RATIO IMPROVEMENT IN ANGLE MODULATION SYSTEMS THROUGH PRE-EMPHASIS AND DE-EMPHASIS
Walter A. Johnston Dec. 1968 23 p refs
(Contract F04701-68-C-0200)
(AD-686468; TR-0200(4230-46)-6; SAMSO-TR-69-93) Avail: CFSTI CSCL 9/4

A general expression is developed for the output signal-to-noise ratio improvement realizable in an angle modulation system as a function of the signal information spectral distribution and the pre-emphasis and de-emphasis transfer functions. In the analysis, the rms deviation at the pre-emphasis network output is held constant. Author (TAB)

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N69-30424# RAND Corp., Santa Monica, Calif.
SOVIET CYBERNETICS: RECENT NEWS ITEMS, VOLUME 3, NO. 2
Dorothy McDonald, ed. and Wade B. Holland, ed. Feb. 1969 114 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-684699; RM-6000/2-PR) Avail: CFSTI CSCL 9/2

This issue features a brochure for the Mir, a small computer for scientific and engineering calculations that accepts alphanumeric and mathematical symbol input via on-line typewriter. A computer logic that can handle natural-language input without a translator is described in an article by Glushkov. A rental bureau for equipment needed only temporarily by scientific and educational institutions is discussed in a short article. Three articles and five short items are concerned with medical cybernetics, particularly space medicine. Reports by four high officials on automation and instrumentation, extracted from Supreme Soviet discussions of the 1969 economic plan, reflect a greater concern this year with automation and instrument construction. This is due to K. N. Rudnev, Ministry of Instrument Construction, Means of Automation, and Control Systems, which is more oriented toward instrumentation and office equipment than toward computers and large systems. Among other items are those on the use of computers in Ukrainian ferrous metallurgy; past and future conferences on industrial psychology, programmed instruction, and automata and artificial intelligence; and scientific organization of labor in Latvia. Articles on hardware include the Polish UMTS-10 computer; a new EDM-450 computer for processing network diagrams without programming; the Moscow automatic traffic control system; and five papertape readers. Author (TAB)

N69-30427*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
CONVOLUTIONAL CODING TECHNIQUES FOR DATA PROTECTION Quarterly Progress Report, 16 Feb.–15 May 1969
James L. Massey 5 Jun. 1969 15 p
(Grant NGL-15-004-026)
(NASA-CR-103207) Avail: CFSTI CSCL 09B

Progress on three subtasks of the program are reported: (1) A powerful, easily-implemented, nonsystematic, binary convolutional code of rate 1/2 for sequential decoding with low error probability has been developed. A description of the code and basic algorithm; implementation of the encoder; and performance of the code are detailed. (2) A Gilbert-like lower bound on the free distance of convolutional codes when used with sequential decoding as a determiner of the decoder error probability has been obtained. (3) Programming has been completed for the simulation of a sequential decoder employing the Jelinek decoding algorithm. K.R.G.

N69-30456 Illinois Univ., Urbana.
GRAPHICAL SPECIFICATION OF COMPUTATION
Fontaine Kelleam Richardson (Ph.D. Thesis) 1968 121 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-1421

This thesis reports on an application of on-line computer graphics to the problem of computer programming. In this investigation, a class of computer systems is proposed which reduces the cost of on-line computer graphics. One of these systems consists of a free standing, inexpensive display device (CRT, light pen, and small computer) connected via a communication link (phone line) to a large supporting computer. The display device is used for the preparation of graphical images (computer programs) and the supporting computer is used for the manipulation of these graphical images (executing the computer programs). The cost of on-line computer graphics is reduced because the display device is inexpensive (projected costs start at $10,000) and the supporting computer is used under the control of a time sharing system which allows the supporting computer to be used for other tasks while it is not needed by the display device. An experimental system, fitting this description, was assembled for this study. Dissert. Abstr.

N69-30472*# Radio Corp of America, Somerville, N.J. Electronic Components.
DESIGN AND DEVELOPMENT OF A DIGITAL SUBSYSTEM EMPLOYING n AND p-CHANNEL MOS F E T'S IN COMPLEMENTARY CIRCUITS IN AN INTEGRATED CIRCUIT ARRAY
Final Report, 1 May 1967–30 Apr. 1968
K. R. Keller and A. Yung Aug. 1968 49 p
(Contract NAS12-119)
(NASA-CR-86171) Avail: CFSTI CSCL 09B

A basic cell for the universal wafer approach was designed and fabricated. The cell, which consists of two groups of four p-channel and four n-channel devices, occupies an area 35 mils by 38 mils. The devices in the cell have a 5-mil channel width, a 0.3-mil channel length, and a 1000 Å oxide thickness over the gate area. The cell design allows a ±0.5-mil tolerance for the final metalizations. A process for two-layer metalization was developed. Typical contact resistance was in the range of 0.7 ohm per square. Two circuits with single-layer metalization were fabricated and tested: a dual inverter circuit using one basic cell with a typical stage delay of 12 nanoseconds; and a J-K flip–flop using two cells and operated at frequencies as high as 2 megahertz. A full-adder circuit with two-layer metalization also was fabricated. Using the universal wafer, a four-stage counter was designed and fabricated in which 16 basic universal cells and two-layer metalization were used. This counter has reset capability. A total of 120 transistors are used in the four-stage counter circuit. It occupies an area 80 mils by 150 mils. The integrated four-stage counter operates at clock frequencies up to 5 megahertz. Author

N69-30674 Stanford Univ., Calif.
THE FORMAL DESCRIPTION AND PARSING OF PICTURES
Alan Cary Shaw (Ph.D. Thesis) 1968 217 p
Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 69-288

A linguistic picture processing model based on a formal picture description scheme is developed and applied. Picture analysis and generation are defined, respectively, as the deviation and execution of descriptions; in both cases, the processing is explicitly directed by descriptions. A detailed realization of the model is presented for a limited class of pictures including, but not restricted to, those containing line-like elements. While some of the results also apply to generation problems, the emphasis is on analysis. A goal-oriented picture parser accepts a grammar and a pattern recognition routine for each primitive class in the grammar, and uses the former to direct the analysis of pictures; a successful analysis produces a complete picture description as output. The parser is an n-dimensional analog of a conventional top-down string parser, where primitive recognizer calls replace calls to the input symbol routine. Dissert. Abstr.

N69-30697*# Kansas Univ., Lawrence. Center for Research in Engineering Science.
IMPLEMENTATION OF PATTERN RECOGNITION TECHNIQUES AS APPLIED TO GEOSCIENCE INTERPRETATION
George W. Dolke [1969] 6 p refs Supported by NASA
(NASA-CR-101755) Avail: CFSTI CSCL 09B

A system using the statistical decision theory to select and transform the essential properties of input data into a form suitable for interpretation by the trained investigator is discussed. Two efforts are involved: applying decision making theory to geoscience sample data, and the investigation of effective techniques for displaying information. It is concluded that this concept of operator involvement in a processing system is well suited for effectively utilizing the power of decision theory and the capabilities of the experienced investigator. F.O.S.

N69-30751# Forsvarets Forskningsanstalt, Stockholm (Sweden).
RANDOM PROCESS GENERATORS [STYDRA SLUMPTALSGENERATORER]
S. Rydstroem Oct. 1967 29 p refs In SWEDISH
(FOA-P-C-8184-11) Avail: CFSTI

The conditions for the existence and the probability of realization are studied for operators with which a random distribution defined by finite values can be transformed to a finite discrete number with a given distribution. The problem thus defined is applicable in determining the operators L(x) such that $\eta = L(\Xi)$ when η and Ξ are random variables with a given distribution. The corresponding theorems, corrolaries, lemmas, and solutions are developed. Transl. by K.W.

N69-30761# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
PROPOSED SYSTEM FOR ON-LINE INFORMATION PROCESSING INCLUDING SEVERAL HIERARCHICAL POSTINGS [PROJET DE SYSTEM DE TRAITEMENT D'INFORMATION EN LIGNE COMPRENANT PLUSIEURS ORDINATEURS HIERARCHISES]
J. Labbe, Ph. Fernier, and J. P. Laget [1968] 14 p ref In FRENCH Presented at Intern. Symp. on Nucl. Electron, Versailles, France, 10 Sep. 1968
(CEA-CONF-1180; CONF-680906-18) Avail: AEC Depository Libraries

A design for an on-line information processing system is proposed which separates the functions of acquisition and exploitation. The acquisition is done by satellite postings of simplified configurations connected with a central posting. This centralizes the results of the measurements and assures the processing. The principle of the system is discussed in some detail. The characteristics of the acquisition and exploitation postings are given. NSA

N69-30859# Airborne Instruments Lab., Deer Park, N.Y.
COMPUTER-AIDED LINE-TYPE MODULATOR DESIGN
Howard S. Bertan *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 351 (See N69-30833 17-09)
Avail: CFSTI

A computer program, designed for use with a time-sharing terminal, was developed to perform a line-type modulator design. The program is stored and called up upon demand. The terminal prints out the necessary operating instructions and requests a minimum of overall performance data input. The data input can be presented in several different forms. The design can be controlled, and a conversation can be held with the computer to yield a multimode modulator design. The computer checks the input data for contradictions. Should a contradiction exist, a diagnosis of the error is printed out. If a solution is possible, the printout presents a complete component specification for the high-voltage dc power supply, charging choke, pulse-forming network, thyratron switch tube, and clipper circuit. All dc and peak voltages, as well as the dc, rms, and peak currents, are calculated. The computer program has been in use for approximately one year and modified to the extent that, in its present form, it is quick and simple to use. A modulator design can be obtained in less than 10 minutes of on-line time by an engineer totally unfamiliar with the computer terminal. Several sample problems are given, complete with computer solution printouts, to illustrate the usefulness of this program as a tool for the modulator design engineer. Several ideas are presented to indicate additional capabilities that can be added for more versatility and inclusiveness. Author

N69-30881# Argonne National Lab., Ill. Applied Mathematics Div.
SPECIAL-PURPOSE LANGUAGE FOR LEAST-SQUARES FITS

Marian Gabriel Sep. 1968 79 p refs
(Contract W-31-109-ENG-38)
(ANL-7495) Avail: CFSTI

A time-saving user language for performing least-squares fits to data is described. The processor is divided into three sections: a translator which generates the required FORTRAN code; a data processor which rearranges all the numerical data into valid input to FORTRAN programs; and the Davidon fitting procedure. Source listings for all codes and cataloged procedure listings are included. NSA

N68-30901# Weapons Research Establishment, Adelaide (Australia).
A HYBRID DIGITAL/ANALOGUE REAL-TIME FOURIER TRANSFORM FILTER
J. W. Crompton Mar. 1969 38 p refs
(WRE-TN-WPD-93) Avail: CFSTI

A method for obtaining, in real-time, the Fourier components of a time-dependent voltage waveform is described. It combines the advantages of digital and analogue techniques thereby apparently offering the possibility of real-time Fourier analysis at speeds in excess of techniques based on the Cooley-Tukey algorithm. The paper provides an outline of the technical principles only. Author

N68-30910# California Univ., Los Angeles. School of Engineering and Applied Science.
THE LOGICAL DESIGN OF A GRAPHICS INTERFACE
M. A. Wingfield Mar. 1969 134 p refs
(Contracts N00014-67-A-0111; AT(11-1)-GEN-10; ARPA SD-184) (AD-686469; UCLA-10P14-74; Rept-69-16) Avail: CFSTI CSCL 9/2

Considerable work is being conducted in the area of computer measurements. An instrumentation computer is being designed which will make measurements on other computers. As a peripheral device to record certain types of data in graphical form, a graphics station was designed and implemented. This thesis concerns the logic design of a graphics interface unit which serves to link a display unit to a computer. Contained within is information describing graphics instructions, CPU orders, interrupt facilities, slave scopes, and keyboard. The logic design is described as well as the hardware components used to implement the graphics station. Finally, a few software application programs are described. Author (TAB)

N68-30950# European Atomic Energy Community, Geel (Belgium). Joint Nuclear Research Center.
AN IBM 1800 PROGRAM PACKAGE FOR ON-LINE AND OFF-LINE OPERATION OF A CALCOMP DIGITAL INCREMENTAL PLOTTER
H. Schmid Brussels 1969 215 p refs
(EUR-4225.e) Avail: CFSTI

A set of IBM 1800 programs for on-line and off-line operation of a Calcomp digital incremental plotter using 8-vector input command format is described. All subroutines are written in ASSEMBLER language and can be called by FORTRAN or ASSEMBLER main program. Data stored as arrays or calculated by a user-written subprogram can be plotted with linear and/or logarithmic scales. The plotter programs permit three different modes of plotter operation: (1) The plotter is operated by a Calcomp magnetic tape unit 570 (7 tracks). The tapes for this unit are prepared by the IBM 1800 computer. (2) The plotter is operated on-line with the IBM 1800 computer as a slow input/output device working with character interrupts. (3) Plotter data are buffered on magnetic tape. The plotter is working on-line with the IBM 1800 computer in time-sharing mode. Author

N68-30972# Stanford Linear Accelerator Center, Calif.
PEG: INTERACTIVE LEAST SQUARES DATA-FITTING PROGRAM
Lyle S. Smith Feb. 1969 87 p refs
(Contract AT(04-3)-515)
(SLAC-95) Avail: CFSTI

An interactive program for data-fitting by the method of least squares is discussed in some detail. The program was implemented on an IBM 360/75 and 360/91 with an IBM 2250 Mod II display unit as the man-machine interface. The least squares data-fitting problem is briefly discussed, and a short description of the direct search minimization method which was chosen to handle the nonlinear least squares problems is given. Finally, the displays utilized in the interactive data-fitting process are depicted by photographs of the 2250 screen during operation, and an extensive discussion of the use of the program is given. The program was written in FORTRAN IV for ease of implementation and to achieve some degree of maching independence. Author (NSA)

N68-30981 University of Southern Calif., Los Angeles
AN INVESTIGATION OF HIGH RESOLUTION DIGITAL DIFFERENTIAL ANALYZERS
Ragnar Nils Nilsen (Ph. D. Thesis) 1968 184 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-636

The development and evaluation of methods for improving the performance of a digital system designed specifically for the solution of differential equations are investigated. While the concept of a machine with which to solve differential equations is not a recent innovation and the devices designed to date have served well in providing understanding and insight into the behavior of dynamic systems, further improvement is possible. A new and more efficient digital system for solving differential equations is proposed. This system results from the introduction of a new logical structure and from an improved incremental algorithm with which to perform integration. An analysis of the error mechanisms inherent in existing digital differential analyzers is presented in order to provide insight and direction toward improving the performance of the digital differential analyzer. Dissert. Abstr.

N69-31005*# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Electrical Engineering.
APPLICATION OF NASAP TO THE DESIGN OF COMMUNICATION CIRCUITS AND EXTENSION OF NASAP ROUTINES TO LARGE SCALE CIRCUITS Final Report
G. J. Herskowitz and M. Sankaran Jun. 1969 52 p refs
(Grant NGR-31-003-050)
(NASA-CR-103218) Avail: CFSTI CSCL 09B

A direct design procedure for arriving at a good initial estimate of the circuit element values is described incorporating NASAP (Network Analysis for Systems Applications Program) into a design algorithm using the method of steepest ascent. The required inputs to the program are listed as topology, desired circuit response and a preselected acceptable error bound between the ideal and the achievable frequency response. The outputs of the program are shown to be the final values of the circuit elements satisfying the ideal frequency response within the acceptable error bound. The program developed is used in two stages, first as a single frequency design using A. C. Constraint Imbedding Program, and then for the optimized design using NASAP 2. Both programs are included. F.O.S.

N69-31036# RAND Corp., Santa Monica, Calif.
EXDAMS: EXTENDABLE DEBUGGING AND MONITORING SYSTEM

R. M. Balzer Apr. 1969 35 p refs
(Contract DAHC15-67-C-0141; ARPA Order 189-1)
(AD-686373; RM-5772-ARPA) Avail: CFSTI CSCL 9/2

The memorandum describes an on-line debugging and monitoring system designed to facilitate experimentation with new on-line debugging and monitoring aids, and to provide flexibility in alternating among these aids as execution time is controlled in either the forward or backward direction. Author (TAB)

N69-31037# Sandia Corp., Livermore, Calif. Systems Hardening Div.
MODIFICATIONS TO THE PUFF 4 -EP HYDROCODE
R. Ng Jan. 1969 10 p ref
(Contract AT(29-1)-789)
(PB-182983; SCL-DR-68-109) Avail: CFSTI CSCL 20D

Four new options have been added to the PUFF IV-EP hydrocode: three equations-of-state, a variable Gruneisen ratio, a variable shear modulus, and a variable yield strength. This report describes these options and the input changes necessary to initiate them. Author (USGRDR)

N69-31090# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A METHOD OF INCREASING THE ACCURACY AND SPEED OF A DIGITAL INTEGRATOR
V. V. Kokhanov et al 6 Dec. 1968 12 p refs Transl. into ENGLISH from Nauchn.-Tekh. Konf. po Avtomat. Upr. Automat. Kontroliu i Vychislitelnoi Tekhn. (Frunz), no. 8, 1967 p 78–85
(AD-685025; FTD-HT-23-705-68) Avail: CFSTI CSCL 9/2

The possible ways of increasing the accuracy and speed of digital differential analyzers are examined. It is concluded that a conversion to multiple digit increments is expedient. The application of various numerical integration equations when operating with multiple digit increments is considered. The investigation was carried out in solving a second order differential equation based on a comparison of equations for rectangles, trapezoids and average rectangles. It is shown that the speed of a digital differential analyzer can be 10-100 times greater than the speed of the parallel-series type machine. The block diagram is given of a computer which can be used to obtain the algorithm described. TAB

N69-31092# California Univ., Los Angeles. School of Engineering and Applied Science.
AUTOMATIC PROGRAM ANALYSIS
Edward C. Russell, Jr. Mar. 1969 177 p refs
(Contract N00014-67-A-0111-0017; AT(11-1)-GEN-10; ARPA SD-184)
(AD-686401; UCLA-10P14-72; UCLA-69-12) Avail: CFSTI CSCL 9/2

The report presents a graph-model of computer programs and then uses this model to develop tools for analysis of programs executing on single and multiprocessors. The tools for analysis include a new method of simplifying program structures through triangularization of the Boolean connection matrix representing the program, integration of execution-time measurement statistics, and post execution display of detailed analysis of critical program segments (those which constitute the major portion of the program both in terms of frequency of execution and execution time). Once the program has been modeled for a single processor, analysis is performed to detect parallelism inherent in the program. A graphical display of potential parallelism, together with detected bottlenecks is presented for further analysis by the programmer. The entire system is designed to be interactive and to act as a guide for the programmer in optimizing his program, whether on a single or multi-processor. Examples of several significant programs including numerical weather prediction, circuit design and Boolean minimization, are completely analyzed, starting from a working program for each written in the FORTRAN language. Author (TAB)

N69-31100# Oak Ridge National Lab., Tenn. Radiation Ecology Section.
EVALUATION OF A DIGITAL COMPUTER METHOD FOR ANALYSIS OF COMPARTMENTAL MODELS OF ECOLOGICAL SYSTEMS
L. J. Bledsoe and G. M. Van Dyne Feb. 1969 61 p refs
(Contract W-7405-ENG-26)
(PB-182982; ORNL-TM-2414) Avail: CFSTI CSCL 09B

The report presents results of development and testing of a FORTRAN program for exploration and analysis of data from experiments in which the system may be depicted by a compartmental model. Both real and artificial data were used to check for rate and type of convergence toward the minimum sum of squares of deviations of observed from predicted data values for each compartment. Data with known degree and kind of error were generated to simulate various degrees of noise encountered in real biological data. Results of these computer studies are presented in graphic and tabular form, limitations of the program are discussed, and program and subroutine listings with directions for use are given in appendices. Author (USGRDR)

N69-31109# RAND Corp., Santa Monica, Calif.
THE INTEGRATED GRAPHICS SYSTEM FOR THE S-C 4060. PART 2: SYSTEM PROGRAMMER'S GUIDE
G. D. Brown, C. H. Bush, and R. A. Berman Jan. 1969 104 p refs
(Contract F44620-67-C-0045)
(AD-686416; RM-5861-PR) Avail: CFSTI CSCL 9/2

A guide for programmers seeking to (1) modify or extend IGS as implemented for S-C 4060, (2) convert IGS for other machines, or (3) design their own character fonts for use with IGS. Directions are given for converting a designed character into its vector-string representation, which the system will convert into data cards that may be stored in a program library or loaded with an individual IGS job. The vector-string characters are unrestricted as to size, shape, or orientation. IGS performs for these vector characters all the functions the 4060 performs for its CHARACTRON set--display, character spacing, line spacing, tabbing, margination, automatic adjustment to accommodate changes, etc. Special debugging routines are provided to test whether a font looks and performs as intended. The memorandum includes a listing of the mode sets; the METAZZ call and metalanguage string used to achieve each of the IGS capabilities; a cross-reference list of the subroutines that call each other; core storage requirements; and directions for use with PL/I programs, as well as a description of each individual system subroutine. The graphics subroutines are described in AD-682 505, which also describes the S-C 4060 and the relationship between IGS and the S-C 4060. Author (TAB)

N69-31112# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
AN ALGORITHM FOR THE SEQUENTIAL PROCESSING OF RADAR MEASUREMENTS
E. V. Yakshevich 14 Feb. 1969 11 p refs Transl. into ENGLISH from Tr. Tsentr. Nauch.-Issled. Inst. Morskogo Flota (USSR), No. 83, 1967 p 58–63
(Contract NOw-62-0604-c)
(AD-686462; APL-CLB-3-T-580) Avail: CFSTI CSCL 17/9

An algorithm based on the method of least squares is established for sequential determination of the elements of motion of an oncoming vessel from the recurrent relationships and an estimate of accuracy. Author (TAB)

N69-31144# Research Analysis Corp., McLean, Va.
RACMAP: AN EXTENSION OF THE IBMAP MACRO PROCESSOR. A PROGRAMMER'S REFERENCE MANUAL
John S. Williams Mar. 1969 37 p refs
(Contract DA-44-188-ARO-1)
(AD-684909) Avail: CFSTI CSCL 9/2

An extension to the macro-processing facilities of the 7040 IBMAP language is described. The new features afford additional capability in the handling of character strings, the selection of macro parameters, and the transferring of control within macros. In addition, features have been introduced that permit decision making during the construction of macro definitions. As a result, the ability of macros to define other macros is considerably extended. Taken together, the RACMAP features significantly increase the range of applications that may be handled by macro processing. Author (TAB)

N69-31168# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
PROGRAM FOR ACQUISITION AND TREATMENT OF NUCLEAR INFORMATION [SYSTEME PROGRAMME D'ACQUISITION ET DE TRAITMENT D'INFORMATIONS NUCLEAIRES]
M. M. Barthelemy 7 Jun. 1968 21 p In FRENCH Presented at Intern. Conf. on Electron. and Automation, Herceg Novi, Yugoslavia, 24 Jun. 1968
(CEA-CONF-1188; DEG/EI/R-2.420/MB/CHD; CONF-680842-1) Avail: AEC Depository Libraries

The development of an analysis system incorporating a digital computer, designed particularly for use in nuclear physics, was described. The system is designed to assure the functions of acquisition, analysis, display, and storage of experimental data. It can also be used for the control of experimental devices to which it is connected. Each component of the analysis system is described. The system is organized around the central computer DATA 620 I. The essential characteristics of the fast coupler, the slow coupler, and the display unit are outlined. The principles to be followed in the programming of the system are summarized. NSA

N69-31218# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
OPTIM: A MULTIDIMENSIONAL NONLINEAR OPTIMIZATION CODE
D. R. Haffner Dec. 1968 65 p refs
(Contract AT(45-1)-1830)
(BNWI-991) Avail: CFSTI

The optimization computer code, OPTIM, is designed to optimize reactor fueling nonlinear problems iteratively for ten or less independent variables by applying a differential approach to a quadratic function with interaction terms derived from a least square fitting technique to a known sample set of data. The program is written in FORTRAN 5 for the Univac 1108 digital computer. Author (NSA)

N69-31223# Atomic Weapons Research Establishment, Aldermaston (England).
SPLINE A FORTRAN COMPUTER PROGRAM FOR THE EVALUATION OF SETS OF EXPERIMENTAL DATA USING CUBIC SPLINE CURVE FITTING AND A STATISTICAL THEORY OF UNKNOWN SYSTEMATIC ERRORS
A. Horsley and J. A. Price Sep. 1968 63 p refs
(AWRE-0-48/68) Avail: CFSTI; HMSO 9s

The S3 (Fortran language) program SPLINE can be used to graduate sets of experimental data using a cubic spline curve fitting method and a statistical theory of unknown systematic errors. Descriptions of the input specification and the output facilities, and a listing of the program are given. The program is at present compiled for operation on the ICT ATLAS 2 computer. Author (NSA)

N69-31242# Institut Fiziki Vysokikh Energii, Serpukhov (USSR).
REPORT ON A COMPILER REALIZING THE FORTRAN LANGUAGE FOR MINSK-22 [SOOBSCHENIE O TRANSYLATORE S YAZYKA FORTRAN DLYA MASHINY MINSK-22]
S. N. Sokolov, P. A. Kalinchenko, I. S. Lupashina, V. A. Makarov, A. S. Markov et al 1968 20 p refs In RUSSIAN
(IFVE-SVM-68-30-K) Avail: CFSTI

A compiler which realizes FORTRAN-IHEP language compatible with CERN FORTRAN is described. The general structure of the compiler and the system of syntax diagnostics and exploitational characteristics are described. A LOAD statement, giving the possibility of program sectioning, is defined. Author (NSA)

N69-31260# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
USE OF UMC DIGITAL TYPE COMPUTERS FOR GEODETIC COMPUTATIONS [ISPOLZOVANIE ELEKTRONNYKH TSIFROVYKH VYCHISLITELNYKH MASHIN TIPA UMC DLYA GEODEZICHESKIKH VYCHISLENII]
I. Gazditski 1967 8 p Transl. into ENGLISH from the publ. "Sredstva i Metody Mekhanizatsii Podgotvki i Polska Nauchno-Tekhnicheskoi Informatsii, Inzhenernogoi Upravlencheskogo Truda" USSR, Ekon. Vzaimopomoshchi, Postoyan. Komis. po Koordinatsii Nauchn. i Tekhn. Issled., 1965 p 181–183
(AD-676215; FTD-HT-23-843-67) Avail: CFSTI CSCL 9/2

The article discusses the compatibility and effectiveness of two types of computers used by the polish geodetic service. The UMC-1 is a small, electron tube, fixed point computer with an access time of the order of 100 operations a second and a magnetic drum memory of 4096 34-bit words; input and output are from punched tape and teletype. The UMC-10 is a transistorized, fixed point computer with speeds of 2000 operations per second, supplementary external magnetic drum memory, punched-tape readers (500 characters per second), punched tape and teletype input and output (150 characters per second). Both types of computers possess identical logical structure and use the same system of coding. TAB

N69-31264 European Organization for Nuclear Research, Geneva (Switzerland).
PROGRAMMING COURSE AND FORTRAN LANGUAGE FOR THE TYPICAL CDC SERIES 6000 COMPUTER. part 4: INPUT AND OUTPUT
F. Louis 13 May 1969 56 p refs In FRENCH
(CERN-69-11) Copyright. Avail: Issuing Activity

Appropriate input and output terms and other instructions for the data processing programmer are outlined in manual form. As a course in programming, for the typical CDC 6000 series using FORTRAN, numerical and nonnumerical formats, specifications for each input datum on a punch card, and all stages of encoding are formulated. A program of second degree equation roots illustrates the programming method and is included. Transl. by N.H.E.

N69-31277*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
ANALOG SPATIAL MANEUVER COMPUTER
George E. Mac Veigh, inventor (to NASA) Filed 6 Jun. 1969 22 p
(NASA-Case-GSFC-10880-1; US-Patent-Appl-SN-831118) Avail: CFSTI CSCL 09B

It is frequently necessary to compute a series of angles through which bodies must move to take them from a known spatial attitude to a desired attitude in space. This computer provides an

indication of three output angles through which a body in space must move to obtain a desired attitude. The output angles are obtained by several gimbal rings arranged concentrically or connected by axles. The gimbals are selectively adjustable so that one of the rings indicates a first spatial attitude of the body while another ring is adapted to indicate the desired attitude of the body. The ring indicating the body's first spatial attitude is placed therein by selective adjustment of other rings, among which are a third ring, adjusted to represent a plane tangent to the earth at a known point; a fourth ring, representing a spatial attitude of an earth support for the body prior to the time it is placed in space; and a fifth ring, adjusted to correspond to an inertial reference device located within the body. Other selectively adjustable rings can be added to correct for drift of the inertial reference means. NASA

N69-31293*# Auburn Univ., Ala. Engineering Experiment Station.
REDUCING QUANTIZER DEADBAND WITH A RANGE SWITCHING DIGITAL FILTER
C. C. Carroll Feb. 1969 99 p refs
(Contract NAS8-11274)
(NASA-CR-102207; TR-15) Avail: CFSTI CSCL 09B

The design, implementation, and testing of a real-time digital filter in a suitable form LSI realization are reported. The design presented here was necessitated by the requirement that the deadband of the analog-to-digital converter be as small as possible. To accomplish this, a range switching filter was designed which employs shorter word lengths and consequently the physical size (component-wise) of the filter is reduced. The compensator, as a special-purpose computer, is then tested in a simulation of the Saturn 5 thrust vector control system and the pendulous integrating gyroscopic accelerometer control loop for which it was designed. Author

N69-31324*# California Univ., Berkeley. Space Sciences Lab.
REAL TIME SYSTEMS AND PUBLIC INFORMATION
C. West Churchman Dec. 1968 8 p Presented at the Fall Joint Computer Conf. on Real Time Inform. Systems and the Public Interest, Dec. 1968 *Its* Internal working paper No. 96
(Grant NGL-05-003-012)
(NASA-CR-103309) Avail: CFSTI CSCL 09B

The feasibility of using computer technology in a future public information system for informing the public on major issues of social policies, and the proper design of such a system are discussed. The relationships of a well informed citizenry and equally well informed government representatives are considered. The problems of morality in designing a public information system are assessed. F.O.S.

N69-31372*# Wolf Research and Development Corp., West Concord, Mass.
DEVELOPMENT OF A COLOR DISPLAY CAPABILITY
Richard Gagan, Frederick Garside, Lee Metrick and Albert Shortell Oct. 1968 94 p refs
(Contract NAS12-680)
(NASA-CR-88176) Avail: CFSTI CSCL 09B

A full color display capability has been developed for existing computer equipment at the NASA-ERC Computer Research Laboratory. The existing equipment included a general purpose digital computer, and a color display oscilloscope comprised of analog driving circuits and a tricolor shadow-mask cathode-ray tube. Interface equipment was designed and constructed. Connection of the equipment involved several modifications of existing equipment. Methods were developed for convenient usage in the specification of display colors. These methods accommodate color specification in terms of hue, saturation, and richness; permit incremental changes of coordinates; and provide for automatic transformation of coordinates to the three-color gun intensities required by the equipment. These methods were incorporated in computer output utility routines which were added to existing graphics software in a compatible fashion. Author

N69-31392# RAND Corp., Santa Monica, Calif.
A FORTRAN PROGRAMMER'S INTRODUCTION TO SIMSCRIPT 2
H. J. Shukiar Mar. 1969 34 p
(Contract F44620-67-C-0045)
(AD-686417; RM-5937-PR) Avail: CFSTI CSCL 9/2

This study is intended to introduce the FORTRAN programmer to some of the main concepts and features of the first three levels of SIMSCRIPT II--the levels which constitute an algebraic compiler. Emphasis is on the power and flexibility that SIMSCRIPT gives the programmer. Among the distinctive features are (1) the SIMSCRIPT preamble; (2) the preamble statements, such as NORMALLY, DEFINE, DEFINE TO MEAN; (3) the fact that any number of conditional expressions can be executed if a logical condition is met; (4) the ability to reread the same records in different formats. Unlike FORTRAN, SIMSCRIPT passes argument values rather than argument locations between subprograms. The method of constructing arrays is radically different. The SIMSCRIPT programmer can conserve core storage, construct ragged tables, generate tree structures, and do list processing with relative ease, and his programs can be read rather than deciphered. Author (TAB)

N69-31460# California Univ., Los Angeles. Dept. of Engineering.
TOOLS FOR THE CONSTRUCTION OF DESIGN AUTOMATION SYSTEMS
Richard L. Mandell Jan. 1969 230 p refs
(Contracts Nonr-233(52); ARPA SD-184)
(AD-686402; UCLA-69-6; UCLA-10P14-68) Avail: CFSTI CSCL 9/2

This study describes a set of software tools for constructing design automation systems. The basic approach was to augment the existing PL/1 language with facilities for constructing translators and for handling variable content variable length records. The translation writing portion of the system includes a flexible graph manipulation facility. The translation facilities are useful for translating design description languages and also for transforming data bases. The report also contains an example of the use of the design tools for constructing an automated system for the design of digital computers. Author (TAB)

N69-31537# California Univ., Berkeley. Lawrence Radiation Lab.
TRIM: A MAGNETOSTATIC COMPUTER PROGRAM FOR THE CDC 6600
John S. Colonias 29 Aug. 1968 51 p refs
(Contract W-7405-eng-48)
(UCRL-18439) Avail: CFSTI

The capabilities and limitations of the magnetostatic computer program TRIM, with particular emphasis on the usage of this program, preparation of input data, and general operating characteristics applicable to the CDC 6600 Computer System are described. Author (NSA)

N69-31554# California Univ., Livermore. Lawrence Radiation Lab.
ECSBIB: A COMPUTER PROGRAM FOR MAINTAINING TECHNICAL BIBLIOGRAPHIES
David W. Thompson 11 Jan. 1969 22 p Sponsored by AEC
(UCRL-50568) Avail: CFSTI

The ECSBIB is a computer program for creating and maintaining a technical bibliography, using magnetic tape storage.

It is applicable to any bibliography that has become cumbersome to maintain because of size. The program produces a comprehensive report, including a unique list of bibliographic sources, complete lists of references sorted alphabetically and numerically, and author list with associated reference numbers. Author (NSA)

N69-31641# Planning Research Corp., Los Angeles, Calif.
ENGINEERING ANALYSIS AND MATHEMATICAL INVESTIGATION OF ANALOG-DIGITAL LINKAGE SYSTEMS
William R. McKean Mar. 1969 57 p refs
(Contract DAAH01-68-C-1485)
(AD-686291; PRC-R-853) Avail: CFSTI CSCL 9/2

The report presents the results of a study to identify and document the performance and design requirements of a analog/digital linkage system capable of providing solutions and data in specified areas of guidance and control simulation. This report includes descriptions of some of the problems to be solved in order to successfully implement an analog/digital simulator. The report also presents the software specifications and the operational requirements for a combined analog/digital simulator. Author (TAB)

N69-31684*# Adams (Charles W.) Associates, Inc., Watertown, Mass.
RESEARCH FOR THE DEVELOPMENT OF SOFTWARE TECHNIQUES FOR COMPUTER-DRIVEN DISPLAYS
Edward N. Chase, Frank S. Greatorex, Robert M. Metcalfe, and James H. Mittica Nov. 1968 83 p ref
(Contract NAS12-601)
(NASA-CR-86175) Avail: CFSTI CSCL 09B

The transformation of graphical data structures to display lists suitable for direct use by a display is described. The display transformation routines presented provide a direct software interface of the source data format to the exact display commands, simulating the functions of an assembler. The routines also implement two-dimensional rotation; scaling and limited scissoring of points, lines, and character origins; and the representation of three-dimensional information, including display of wire frame points, lines, and character origins; and three-space to two-space projections. The algorithm for rotation, scaling, and three-space to two-space projection is centered around an input transform of 17 words. Twenty-seven mainline routine flowcharts, nine service routine flowcharts, and twelve scissor routine flow charts are included. M.H.E.

N69-31672# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
GAMBIT PROGRAM
George Collier and Gordon Gibson Apr. 1968 87 p refs
(WANL-TME-1752) Avail: CFSTI

The GAMBIT is a FORTRAN 4 program that provides broad-group flux and current averaged neutron cross sections. They are based on a thermal cross section library consisting of 99 fine groups (0 to 2.38 eV), and a fast-neutron library consisting of 68 fine groups (0.414 to 10 MeV, 1/4 lethargy intervals). The fluxes and currents required to obtain the broad-group cross sections may be calculated with GAMBIT or may be entered into the program. In addition a Maxwellian spectrum may be used in the thermal range. If the flux is calculated, either the B1 or P1 method of solving the transport equation may be used. In effect the steady state transport equation is solved for an infinite medium problem. The program provides cross sections for a full P(1) transport calculation; cards are punched out in a format suitable for input to the ANISN and DOT discrete-ordinates transport codes. The manner in which BIT (thermal code) is linked to GAM (high-energy code) is described as well as the thermal code BIT. The GAM code is documented. Author (NSA)

N69-31681# Battis Atomic Power Lab., Pittsburgh, Pa.
NOWIG: A PROGRAM TO SOLVE THE POINT KINETICS APPROXIMATION TO THE ONE-DIMENSIONAL, TWO-GROUP DIFFUSION EQUATIONS WITH TEMPERATURE FEEDBACK
J. B. Yasinsky Jan. 1969 34 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-806) Avail: CFSTI

The NOWIG is a computer program for solving the one-dimensional two-group neutron diffusion and delayed precursor equations within a shape-specified point kinetics approximation. Feedback due to changes in the regionwise constant fuel metal temperature and coolant density is accounted for using a model which is identical with that used in the WIGL2 program. NOWIG is meant to be a companion tool with WIGL2 or WIGL3 which will permit determination of errors inherent in neglecting flux shape changes for dynamic problems with temperature feedback. The governing equations, solution techniques, and input information are included. Author (NSA)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N69-30419# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A PULSE SOURCE FOR HEAVY, SHORT-DURATION CURRENT
S. P. Bugayev et al 4 Dec. 1968 8 p refs Transl. into ENGLISH from Izv. Vyssh. Uchcb. Zaved., Fiz (Tomsk), no. 1, 1968 p 145–147
(AD-686021; FTD-HT-23-1031-68) Avail: CFSTI CSCL 9/1

A source has been developed for short (10–100nsec) electron pulses with an amplitude of 2000 amp. Its performance is based on the extraction of electrons from discharge plasma in vacuum. A unique plasma cathode design made it possible to obtain an electron current density of 200 amp/sq cm. The source proposed by the authors provides for a uniform distribution of the discharge plasma over a large surface of the cathode. For this purpose, the electrode system consists of a corrugated metallic mesh on a substrate with a high dielectric constant. The opposite side of the substrate is cooled with a metallic film. The thickness of the substrate, the dielectric constant, and the pitch of the mesh are selected so as to produce an optimum configuration of internal capacitances for the breakdown distribution. The design allows for the formation area of these surfaces without changing the density of the current. Author (TAB)

N69-30440 Stanford Univ., Calif.
EFFECTS OF ELECTRODE TEMPERATURE ON MHD GENERATOR PERFORMANCE
Robert Kessler (Ph.D. Thesis) 1968 115 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-241

Experiments were performed in a combustion-driven MHD generator to determine the effects of electrode temperature and boundary-layer temperature on its performance. The generator was a single electrode pair guarded to avoid end effects by two electrode pairs both upstream and downstream. The five electrode pairs were preceded either by a cold (750°K) water-cooled metal plate or by a hot (2400°K) wall made of magnesium oxide. The electrodes were held at three temperature levels, 775°, 1475°, and

1685°K, by controlling individual cooling circuits. Two sets of electrode boundary-layer temprature profiles were investigated: one resulting from the cold metal upstream wall and the other resulting from the hot ceramic upstream wall. Probes were installed in the insulator sidewall between the center pair of electrodes to measure the voltage profile in the gas. Visual and photographic observations of the electrodes were made. Dissert. Abstr.

N69-30833# New York Univ., N.Y. Electron Devices Group.
PROCEEDINGS OF THE TENTH MODULATOR SYMPOSIUM
May 1968 368 p refs Meeting held at New York, 21–22 May 1968
(Contract DA28-043-AMC-00039(E))
(AD-676854) Avail: CFSTI CSCL 9/5

The conference papers pertained to high power, high voltage modulator design and circuitry for use in linear accelerators and radar systems. For individual titles, see N69-30834 through N69-30859.

N69-30834# Brookhaven National Lab., Upton, N.Y.
MODULATOR APPLICATIONS IN HIGH ENERGY ACCELERATORS
E.B. Forsyth *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 1–9 refs Sponsored by AEC (See N69-30833 17-09)
Avail: CFSTI

A general survey of linear and circular accelerators and the experimental apparatus used with them is presented. The types of modulator circuits in the machines are also broadly categorized. Due to the brief nature of the presentation, only electron and proton accelerators in the multi-GeV range are treated. A.C.R.

N69-30835# Los Alamos Scientific Lab., N.Mex.
EIGHTY KILOVOLT BLOCKING OSCILLATOR MODULATOR
J. D. Doss, R. L. Cady, D. C. Hagerman, and T. F. Turner *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 10–21 Sponsored by AEC (See N69-30833 17-09)
Avail: CFSTI

Four modulator configurations for use by the linear accelerator at the Los Alamos Meson Physics Facility are described and evaluated as to their relative advantages and disadvantages. Each of the four incorporates one of the following design features: (1) dual-tube, high inductance coupling transformers; (2) single-tube, high inductance coupling transformers; (3) a light-pipe interface which eliminates the use of coupling transformers; or (4) blocking oscillator, regenerative circuitry which also eliminates the coupling transformers. The circuitry, operating characteristics, and full-voltage test performance of the modulators are discussed, and it is reported that each configuration met the basic electrical requirements. The conclusion is reached that the regenerative, blocking oscillator design, which represents a compromise between the other types, is the most promising replacement for the high inductance coupling transformer method despite precautions which must be taken during modulator operation. A.C.R.

N69-30837# Varian Associates, Palo Alto, Calif. Radiation Div.
A UNIQUE METHOD FOR POWER PULSE SHARPENING
Vance Valencia and Dennis Morris *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 41–46 (See N69-30833 17-09)
Avail: CFSTI

A nonlinear, delay line, pulse shaping technique which combines the long-life, low-jitter thyratron pulser with passive elements to provide a stable system is described. Basic theory is analyzed, taking into consideration the nonlinear properties of the material and the structure in which the wavefront is formed. Developmental tests verified the theoretical hypothesis, although the results were not optimal. It was concluded that at low power levels, tunnel diodes and avalanche transistors are relatively economical and difficult to replace with a pulse shaping technique. At medium and high power levels, however, the method is easily implemented and there are no other devices available for this purpose other than hard tubes, which do not equal the performance of pulse shaping devices. In addition, future extensions for nanosecond switching could provide power in the hundred kW range at rates in the kHz region. A.C.R.

N69-30838# California Univ., Livermore. Lawrence Radiation Lab.
REGULATED MAGNETIC BURST GENERATOR
Kristan Aaland and Edwin P. Westbrook *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 47–56 refs Sponsored by AEC (See N69-30833 17-09)
Avail: CFSTI

A 20-kW peak power pulse generator, used in a group of 20 generators supplying pulses to an array of instrumentation sensors at a combined pulse rate of 4 MHz, is described. The required 20-kW peak input power level is related to a pulse width of 0.2 μsec and an amplitude resolution and accuracy of 0.1%. A push-pull switching core, 1:20 step-up transformer is driven from 150 V dc by high speed, high voltage switching transistors operated in current-sharing parallel-connected groups. Negative feedback maintains constant current charging of a pulse-forming network on the secondary during the approximately 3 μsec to core saturation, after which the network discharges into a 50 ohm output cable. Author

N69-30839# Lockheed Electronics Co., Plainfield, N.J.
SWITCHING OF 80-NANOSECOND HIGH POWER PULSES AT 30-KILOHERTZ RATES BY MEANS OF SCRs
V. Nicholas Martin *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 57–71 refs (See N69-30833 17-09)
Avail: CFSTI

Three major modulator designs are reviewed which incorporate silicon controlled rectifiers. These include: (1) an airborne, 10-kW modulator providing 80-120 nsec pulses at a pulse repetition rate of 30 kHz; (2) a 4-kW floating deck modulator providing 0.5 μsec pulses at 25 kHz; and (3) a solid state modulator capable of switching 180 kW, 100 nsec pulses at 25-kHz rates. A.C.R.

N69-30840# Hughes Aircraft Co., Culver City, Calif.
TRANSISTOR SWITCHING CIRCUITS
G. Sloan and J. V. Stover *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 72–82 (See N69-30833 17-09)
Avail: CFSTI

A new class of high power semiconductor switches using transistors as the basic switching device is described and evaluated. Various types of circuitry utilized in the device are treated, such as the floating deck, series cascade, series interconnected, and complementary pair circuits. It was concluded that these transistor configurations offer significant advantages over the more conventional types, although they have the singular disadvantage of having greatly increased complexity. A.C.R.

N69-30841# Marconi Co., Ltd., Chelmsford (England).
CIRCUIT CONFIGURATION AND THYRISTOR RATING FOR SOLID STATE MODULATORS
T. H. Robinson *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 83–107 refs (See N69-30833 17-09)
Avail: CFSTI

The relationship between the circuit configuration of solid state modulators and the parameters which set the switching capacity of thyristors is outlined as a logic diagram. Analysis of the diagram indicates that the switching capacity is directly dependent upon the peak temperature reached in the thyristor slice and the integrated effect of this dynamic temperature rise on the mean temperature of the thyristor. It was found that switching capacity can be increased by the use of current priming, which enables the switched current to be increased without exceeding the peak and mean temperature limits. This enhancement of performance is exploited by connecting the correctly rated thyristor in one of several ways, depending on available power sypply, size and weight limits, and system requirements for stability and efficiency. Three systems are also described to demonstrate the interrelationships between circuit configuration and the correct rating of pulse thyristors. A.C.R.

N69-30842# Stanford Univ., Calif.
EVALUATION OF THE CAPABILITIES OF ELECTRON BEAM: pn JUNCTION DEVICES AS PULSE MODULATORS
C. B. Norris, Jr. *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 108–154 refs (See N69-30833 17-09)
(Contract DAAB07-67-C-0320)
Avail: CFSTI

The large-signal transient characteristics of an elementary electron beam-pn junction amplifier and the optimum gain, rise time, and output capability that can be obtained from this device are analyzed theoretically and compared with experimental results. Since the properties of modulated electron sources are well understood, attention is concentrated on the characteristics of the beam diode. Its structure for high power, fast rise time application is treated, along with the effects produced by electron bombardment. The mechanism responsible for the large current gain of the diode and the parameters which determine the rise times are also analyzed. Factors affecting the output amplitude obtainable in linear operations, as well as methods of maximizing the linear current, voltage, and power output in a given application, are taken into account. Finally, experimental results which display the high current, subnanosecond rise time, switching capability of the beam diode are described. A.C.R.

N69-30843# Westinghouse Electric Corp., Baltimore, Md. Surface Div.
LIGHTWEIGHT, HIGH POWER MODULATOR USES RSR SWITCH DEVICE
R. A. Hill and W. R. Olson *In* N.Y. Univ. Proc. of the 10th Modulatory Symp. May 1968 p 155–163 (See N69-30833 17-09)
Avail: CFSTI

A lightweight, line-type modulator presently under development is described. The device uses reverse switching rectifiers (RSR) to achieve a significant size and weight reduction, as compared to conventional designs, and is intended to operate as a working model for a 10-Mw peak power, 120-kV output modulator which utilizes low voltage, solid state components in a modular construction. The two key components in the modulator are the RSR and a high-turns ratio, pulse transformer. The RSR is used as the pulse switching element in pulser modules. The output power of 20 modules is combined into a single pulse transformer having a 130:1 turns ratio. A.C.R.

N69-30844# Hughes Aircraft Co., Culver City, Calif.
A VERSATILE TRANSISTOR MODULATOR FOR TWT GRID MODULATOR APPLICATION
J. V. Stover and M. J. Westby *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 164–176 (See N69-30833 17-09)
Avail: CFSTI

The design and performance characteristics of a solid state modulator of the floating deck type for use with a gridded traveling wave tube (twt) is presented. The device incorporates the following components: (1) a signal processor for generating the necessary low level trigger circuitry to control the floating deck circuitry and to couple these triggers through the twt cathode voltage; (2) an on/off predriver to further amplify the trigger signals from the signal processor; (3) a bistable on switch to apply and remove positive grid to cathode voltage; (4) an off switch which momentarily turns on to discharge the stray grid to cathode capacity; and (5) the necessary floating modulator and modulator biasing supplies. Results of reliability testing over the ambient temperature range 0° to 85°C indicate satisfactory performance of the avalanche and other circuitry at the operating current levels of the transistors during both normal and abnormal service. Author

N69-30845# National Electronics, Inc., Geneva, Ill.
A MULTIPLE SPOT TURN-ON HIGH DI/DT THYRISTOR
Donald I. Gray *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 177 (See N69-30833 17-09)
Avail: CFSTI

The silicon controlled rectifier (SCR) is a superb switching device in low frequency circuits, but its use in high frequency circuits has been limited by an inability to withstand high di/dt. A basically new concept for triggering, called the regenerative gate, overcomes the di/dt and poor area utilization limitation of conventional SCRs. The regenerative gate SCR samples applied circuit voltage and current, and then by a proper sequence of internal switching, increases the turned-on area according to the di/dt demand. The device will operate with full di/dt capabilities using low-power gate drive. The di/dt capabilities are extended by the regenerative gate concept, while switching losses are reduced. Experiments were performed showing that a modified regenerative gate design will allow forward-breakover-voltage firing at the same high di/dt as is obtained with gate firing. The regenerative gate device will ultimately close the frequency gap between the SCR and transistors, due to the reduction in switching losses coupled with better device area utilization. Author

N69-30846# Sylvania Electric Products, Inc., Waltham, Mass. Applied Research Lab.
A PULSE MODULATOR USING HIGH POWER STEP RECOVERY DIODES
Anthony R. Ingegneri *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 178–192 refs (See N69-30833 17-09)
Avail: CFSTI

The design, circuitry, and breadboard model of a pulse modulator capable of operating at a continuously variable pulse width from 0.1 μsec to several μsec are described. This device represents improvement over existing solid state modulators which produce high peak power, since the latter types are usually restricted to operation at a single pulse width and pulse repetition rate. Application of the new design to inductive storage modulators and pulse shaping operations was also demonstrated. A.C.R.

N69-30847# Continental Electronics Mfg. Co., Dallas, Tex.
DEVELOPMENT AND TEST OF A 50 MEGAWATT HIGH VACUUM PULSE MODULATOR TUBE
J. J. Tritcher (ITT Electron Tube Div.) and W. L. Willis *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 193–202 (See N69-30833 17-09)
Avail: CFSTI

A high-vacuum power triode capable of long pulse and high voltage operation was developed using a mesh constructed

thoriated tungsten cathode. Cathode power of 30 kW was required to provide a 50% emission margin to compensate for end cooling losses and unexposed cathode surfaces. Preliminary testing yielded the following performance characteristics for the tube: (1) cathode pulse emission up to 1700 A; (2) approximately 1000 A plate current pulses at 1% duty; (3) voltage hold-off capacity, under pulsing conditions, in excess of 60 kV dc; and (4) tube pulse switching in excess of 50 MW power output. A.C.R.

N69-30848# Army Electronics Command, Fort Monmouth, N.J. Electronic Components Lab.

HIGH VOLTAGE VACUUM BREAKDOWN CONSIDERATIONS FOR TUBE DESIGN

M. M. Chrepta and George W. Taylor *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 203–210 refs (See N69-30833 17-09)

Avail: CFSTI

Results of recent research into high voltage breakdown under vacuum conditions are discussed and compared with existing theories. It is emphasized that each device has its own particular definition of breakdown, which is determined by the type of service required of it. Based on observations from several types of experiments, recommendations are made for preparing an electrode system for high voltage vacuum operation. These include the use of refractory materials, particularly for the anode members, due to the high temperature attained from high density currents. In addition, electrodes should be vacuum baked for at least eight hours and mechanically polished with abrasives whose particle sizes are between 1 and 10 microns. Electrode geometries should ensure that no sharp transitions are allowed; they may have small radii, but a high gas conductance capability through the gaps is required. It was also concluded that factors affecting breakdown will often interact in a particular system and that the tube designer should therefore consider all such possibilities in order to achieve optimum operation. A.C.R.

N69-30849# Westinghouse Electric Corp., Baltimore, Md. Surface Div.

OIL IMMERSED HIGH-VOLTAGE CROWBAR

C. K. Hooper and B. L. Drummond *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 211–234 refs (See N69-30833 17-09)

Avail: CFSTI

A high power transmitter using a series hard-tube modulator rather than the more standard line-type modulator is described. The need for a crowbar, an electronic switch which causes rapid short circuiting of the energy storage capacitor in case of an electrical fault, is discussed, as well as the reasons for choosing an oil-immersed, multigap unit. Performance specifications required that crowbar operation begin at the instant any fault occurs; it was determined that a series array of gaps must ionize within two μsec from sensing of the fault to achieve this objective. Preliminary design studies identified the main parameters which determine effective operation are: (1) performance of two hydrogen thyratrons; (2) voltage rise time at the pulse transformer secondary; and (3) ionization time in both the sharpening gaps and the main discharge gaps. Calculations, analysis of previous data, and tests were performed to insure that the parameters were met in the final design. Foil tests were then conducted as a final check of system reliability; these yielded satisfactory results. A.C.R.

N69-30850# General Electric Co., Philadelphia, Pa.

TRIGGERED VACUUM GAPS AS ENERGY DIVERTERS IN ELECTRONIC EQUIPMENT

A. Michaelson and H. N. Price *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 235–251 refs (See N69-30833 17-09)

Avail: CFSTI

Triggered vacuum gap devices for application to energy diversion circuits during a load fault are described. These devices use extremely high purity, gas-free copper electrodes so that the melting of copper electrodes which occurs during main gap conduction does not result in degradation of the vacuum space. Energy diverter switch requirements are summarized, with assessment of the performance of the triggered vacuum gaps for each parameter. A typical firing circuit employing a design which meets all of the criteria for energy diversion in military and industrial electronic equipment is then treated. A.C.R.

N69-30851# Army Electronics Command, Fort Monmouth, N.J. Electronic Components Lab.

FIRING CHARACTERISTICS OF MULTIPLE-ELECTRODE TRIGGERED VACUUM GAPS

Sol Schneider, Anthony J. Buffa, and John E. Creedon *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 252–261 refs (See N69-30833 17-09)

Avail: CFSTI

Results of continuing design studies are presented for a multiple-electrode, triggered vacuum gap to operate at 300 kV as an energy diverter in the event of an electrical fault. In designing these new tubes, the primary objective was to achieve minimum firing times without sacrificing voltage hold-off reliability. The arc length was therefore considerably shortened, and the ceramic sidewalls were shielded from the arc. Three designs were constructed: a six-gap tube, a three-gap tube, and a modified version of the three-gap tube with addition of a hydrogen reservoir. The firing characteristics of these tubes were studied from 1 to 300 kV, and the influence of low pressure hydrogen on firing and hold-off performance was evaluated. A.C.R.

N69-30852# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.

A NEW VACUUM CONTROLLED SWITCH FOR HIGH-POWER-PULSE GENERATION AND CROWBAR SERVICE

A. S. Gilmour, Jr. and D. L. Lockwood *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 262–273 refs (See N69-30833 17-09)

(Contract AF(30(602)-3959) Avail: CFSTI

A new switching device is described, which is capable of operating at several kilovolts and hundreds of amperes, at pulse repetition frequencies of at least several tens of pulses per second, and at pulse widths continuously adjustable down to a few microseconds. The device, with an anticipated ultimate voltage capability of at least several tens of kilovolts, employs a vacuum arc as an emission source and utilizes an axial magnetic field in a cylindrical geometry for current control. The voltage drop across the switch is a function of the cathode material and is typically from 10 to 20 volts. In the case of a zinc cathode the drop is approximately 15 volts. Preliminary studies of the turn-on and turn-off times during pulsed operation indicated that these times can be made shorter than 2 microseconds with little difficulty. A qualitative description of the operation of the device is given, which is based on published information and on information obtained during recent studies of vacuum arcs. Author

N69-30853# Ion Physics Corp., Burlington, Mass.

MEGAVOLT MODULATORS FOR NANOSECOND RADAR

J. J. Moriarty and G. K. Simcox *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 274–294 refs (See N69-30833 17-09)

Avail: CFSTI

The design of megavolt modulators for processed pulse durations in the nanosecond regime for radar receivers is discussed. The configuration allows an increase in peak power radar transmission

by orders of magnitude and provides the option of returning to the simple pulse mode of operation. In general, such improvement is possible because the electrical strengths of dielectric media are enhanced for the shorter nanosecond pulses to such an extent that it is possible to consider the application of megavolts to structures and devices which may be limited to several hundred kilovolts for longer pulses. The field emission cathode, capable of 10^7 A/cm^2 with applied electric fields of 10^7 V/cm, was determined to be applicable to nanosecond pulse duration and suitable for megavolt operation. An outline of the complementary technologies of nanosecond radar and megavolt systems is included, together with the possible modulator developments which could accrue from them. A.C.R.

N69-30854# Varian Associates, San Carlos, Calif. Radiation Div.

OPTIMUM CIRCUIT PARAMETERS FOR MAXIMUM SWITCHING SPEED OF SMALL HYDROGEN THYRATRONS

Jerry G. Jensen *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 295-306 refs (See N69-30833 17-09)

Avail: CFSTI

In an effort to extend fast pulse applications in the linear accelerator field, research was directed toward high power pulsers capable of producing 4 kV pulses with rise and fall times in the 5 nsec range. Emphasis was placed on radar, modulator-type, thyratron pulsers and their optimum operating parameters. A series of performance tests were conducted, and the results indicated several operating conditions under which switching speeds could be maximized. A.C.R.

N69-30855# California Univ., Livermore. Lawrence Radiation Lab.

A HIGH-POWER HYDROGEN THYRATRON WITHOUT GRADIENT GRIDS

Lloyd Mancebo *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 307-315 refs Sponsored by AEC (See N69-30833 17-09)

Avail: CFSTI

A high voltage tube was designed which eliminates the problems of triggering and voltage hold-off within the tube and the compensated external voltage divider. This thyratron operates at rates up to 120 kV, using only one grid anode structure and pure hydrogen. Analysis of the field emission limits of the tube is presented, and it is concluded that the coaxial design lends itself to water-cooling of the anode, as well as of the grid. The grid anode capacity can also be minimized for improved high reprate characteristics, such as anode heating. A.C.R.

N69-30857# Army Eletronics Command, Fort Monmouth, N.J. Electronic Components Lab.

A ONE-MEGAWATT AVERAGE-POWER PULSE MODULATOR

Anthony J. Buffa and Frederick A. Vorwerk *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 326-336 refs (See N69-30833 17-09)

Avail: CFSTI

Previously derived design concepts for high voltage and high current thyratrons were utilized to experimentally construct an interative-grid device capable of simultaneously switching 350 MW of peak power and 1 MW of average power at a peak forward voltage of 70,000 V. The power capabilities of this device are much greater than any switch available for radar-type applications. The various parameters and the three objective operating conditions for both the switch tube and the modulator are listed. Author

N69-30858# European Organization for Nuclear Research, Geneva (Switzerland).

A HIGH VOLTAGE THYRATRON SWITCH FOR THE FAST INFLECTOR OF THE ISR

H. O. Hanlon and J. P. Zanasco *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 337-350 (See N69-30833 17-09)

Avail: CFSTI

The electrical circuit of the fast inflector for intersecting storage rings consists of a pulse forming network (pfn) which is discharged into a transmission line-type magnet. The pfn consists of two, coaxial, high voltage cables of 28Ω impedence connected in parallel. The magnet has the same characteristic impedance (14Ω) as the pfn and is terminated with a load resistor of 14Ω. The maximum high voltage specification for the fast inflector is 42 kV on the pfn, corresponding to a current of 1.5 kA in the magnet; the pulse length on the flat top is 2.1μsec. For these requirements a deuterium-filled, double gap, tetrode thyratron was tested in a coaxial circuit. Author

N69-30865# Army Electronics Command, Fort Monmouth, N.J.

A VERY BROAD BAND LOW SILHOUETTE ANTENNA

John L. Kerr Jan. 1969 62 p

(AD-684915; ECOM-3087) Avail: CFSTI CSCL 9/5

The report describes the development of a very broad-band, lightweight, linearly polarized, low silhouette antenna which operates over a bandwidth in excess of 12:1. The antenna consists of a very short section of a double-ridged waveguide, with a coaxial input, which is used to launch a wave on logarithmically curved extensions of the ridges. Radiation pattern, gain and VSWR data for an experimental model, which operates over the 1 - 12 GHz frequency range, are presented. A technique for reducing back and side radiation, as well as improving the VSWR performance at the lower end of the frequency range, is discussed and experimental results are included. These data show that a backward travelling wave, reflected from the tips of the radiators, leads to high back and side lobes and introduces violent oscillatory excursions into the VSWR curve at the lower end of the frequency range. Author (TAB)

N69-30872# Norges Tekniske Hoegskole, Trondheim. Elektronikklaboratoriet.

TREATMENT OF THIN SILICON OXIDE FILMS (HEAT TREATMENT, GAS INJECTION) [ETTERBEHANDLING AV TYNNE SILICIUMMOKSYDFILMER (VARMEBEHANDLING, GASSINNSLIPP)]

Morten Ulrikanker 20 Sep. 1967 17 p In NORWEGIAN; ENGLISH summary

(I-51) Avail: CFSTI

Conduction and loss mechanisms were studied in thin vacuum-deposited SiO_x films, with emphasis on the influence of the controlled inlet of various gases. Apparatus, experimental procedure and results are described. An apparatus was designed which allowed electrical measurements while the capacitors were still in vacuo. The deposition procedure was standardized. Using a quartz crystal thickness monitor, the capacitance values were reproducible to within ±5%. The substrates were unheated during deposition. Immediately after deposition, tan δ was in the range of 1 to 4%, and decreased when the capacitors were stored in vacuo. The capacitors were annealed in vacuo, which drastically improved electrical properties. Tan δ decreased to <0.1%, C by about 9%. One of the following gases was then let into the chamber: helium, argon, dry or normal air, dry or wet hydrogen. Only normal air and wet hydrogen had any influence, leading to an increase in C (1-2%) and tan δ (new value up to 0.2%). This is a reversible process, the original values being obtained after evacuation and new annealing. The conclusion is that water vapor is the active constitutent in these cases. Author

N69-30899# Army Electronics Command, Fort Monmouth, N.J.
OUTPUT SIGNAL-TO-NOISE RATIO AND OUTPUT CORRELATION FUNCTION OF NONLINEAR DEVICES HAVING GENERALIZED HYPERGEOMETRIC OR POLYNOMIAL TRANSFER CHARACTERISTICS
K. Westemeon Jan. 1969 82 p refs
(AD-684913; ECOM-3082) Avail: CFSTI CSCL 9/1

Memoryless nonlinear devices are investigated whose transfer characteristics can be approximated by a generalized hypergeometric function (in this report designated GHF) or by a polynomial. They are fed by a sinusoidal signal plus narrow-band Gaussian noise and their output signal-to-noise ratio R, in the mth harmonic zone, is derived as a function of their input signal-to-noise ratio rho and in terms of the parameters of the GHF or in terms of the coefficients of the polynomial. As an example, an error-function limiter is included. The limiters R as a function of rho is easily obtained. Approximations of R for small and large rho are also given for this limiter and for polynomial devices. In addition, the output correlation function is obtained for odd nonlinearities with GHF or polynomial transfer characteristics when their inputs consist of Gaussian noise alone. Several examples of GHF devices are included whose correlation function reduces to a closed-form expression.
Author (TAB)

N69-30938# Auburn Univ., Ala. Antenna Study Group.
STUDY OF CIRCULAR ARRAYS OF RADIAL AND TANGENTIAL DIPOLES Final Report, 1 Mar.–31 Dec. 1968
C. E. Hickman and M. B. Carter 31 Dec. 1968 34 p refs
(Contract F19628-68-C-0200)
(AD-685167; AFCRC-69-0076) Avail: CFSTI CSCL 9/5

The report contains the results of studies of an array of dipoles oriented tangential to a circle with the plane of the array parallel to an infinite lossless ground plane. In particular, an integral equation is obtained in which the unknown is the current distribution on the elements of the array. Also, an expression for the radiation patterns is determined and the theoretical pattern is compared to the experimental pattern for the zero voltage sequence connection.
Author (TAB)

N69-30999# Naval Air Development Center, Johnsville, Pa. Aero-Electronic Technology Dept.
ANALOG TARGET SIMULATION OF SONIC PULSES
Kurt L. Ettenhofer 24 Feb. 1969 140 p refs
(AD-684803; NADC-AE-6767) Avail: CFSTI CSCL 17/1

This study describes three phases of work to develop the analog target simulator. The results of the model tests show that it is possible, with careful design and proper choice of electro-acoustic transducers, to develop an analog target simulator that will accurately simulate real scattering bodies.
Author (TAB)

N69-31084*# Naval Aerospace Medical Inst., Pensacola, Fla.
A VENTING ALARM SYSTEM FOR CRYOGENIC LIQUIDS
Efrain A. Molina and Vernon R. Reno 10 Feb. 1969 11 p
(NASA Order R-39)
(NASA-CR-103267; NAMI-1059; Rept-1) Avail: CFSTI CSCL 09E

An alarm system was designed that continuously monitors the gas output from vessels in which cryogenic liquids are either stored or used. The system is fail safe in nature. It gives a visual and an auditory alarm in the event that venting provisions are restricted or a component failure takes place. Repeated manual checking of venting is eliminated, thus allowing the experimenter to concentrate upon the investigation without risk that high pressures may be developing within the system.
Author

N69-31113# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Electrophysics.
RAY-OPTICAL TECHNIQUES FOR WAVEGUIDE DISCONTINUITIES
Hung Yuet Yee and Leopold B. Felsen Jun. 1968 195 p refs
(Contract F19628-68-C-0072)
(AD-685168; SR-3; PIBEP-68-005) Avail: CFSTI CSCL 9/1

Ray methods are employed in connection with scattering by discontinuities in waveguides is analyzed in the work reported here. Since the notion of a ray is generally associated with the local propagating plane wave fields encountered at high frequencies, it is to be expected that ray solutions apply only when the wavelength is small compared with critical dimensions of a guiding or scattering structure. However, it is shown that even the low frequency regime can be accommodated with good accuracy, thereby making the ray-optical techniques a powerful tool for the study of waveguide scattering problems. To render a ray method analysis useful, it is necessary to convert these fields into a sum of waveguide modes whose amplitudes furnish the modal reflection, transmission and coupling coefficients. This conversion can be accomplished systematically in parallel plane and circular regions. Reflection from the open ends of parallel plane waveguide is analyzed in detail. In the unflanged case, the ray results agree remarkably well with the exact solutions even for wavelengths as long as six times the width of the guide. Data are also presented for flanged terminations for which no exact solution is available.
Author (TAB)

N69-31225# Motorola Inc., Phoenix, Ariz. Semiconductor Products Div.
RADIATION HARDENED JUNCTION FIELD EFFECT TRANSISTORS
William George Dec. 1968 40 p refs
(Contract F19628-68-C-0141)
(AD-686186; SR-1; AFCRL-69-0077) Avail: CFSTI CSCL 9/1

The fabrication and testing of radiation hardened junction field effect transistors is described. Several structures were evaluated, including p- and n-channel devices of fixed geometry and dopant concentration, n-channel devices with fixed dopant concentrations, but different mask geometries, and n-channel devices with several channel dopant concentrations. The report describes and presents experimental verification of a technique which allows achievement of relatively high breakdown voltages in heavily doped devices.
Author (TAB)

N69-31267*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MICROWAVE POWER RECEIVING ANTENNA
Carrol C. Dailey, inventor (to NASA) Filed 1 May 1969 13 p
(NASA-Case-MFS-20333; US-Patent-Appl-SN-820965) Avail: CFSTI CSCL 09E

This invention relates to power receiving antennas in general and specifically to a rectifying dipole antenna array having a highly efficient structure for dissipation of heat from the rectifying circuit. The array has a solid-state rectifier circuit at the center of each of a plurality of dipole antennas for converting the hf energy to direct current. The construction solves the problem of heat dissipation from the diode rectifier enclosure by using the dipole supporting posts, the antenna reflector, and the dipole elements as heat pipe devices. All supporting posts and the antenna reflector function jointly for greater efficiency in dissipating heat; they also can be physically separated to simplify fabrication and maintenance.
NASA

N69-31307# Naval Research Lab., Orlando, Fla. Underwater Sound Reference Div.
BIBLIOGRAPHY OF MOVING-COIL (DYNAMIC) AND IMPULSE TYPE UNDERWATER ELECTROACOUSTIC TRANSDUCERS

John E. Donovan 15 Apr. 1969 43 p refs
(AD-686378; NRL-BIB-32) Avail: CFSTI CSCL 9/1

References obtained from a search of the Underwater Sound Reference Divisions library holdings and the issues of Physics Abstracts from January 1950 through May 1968 are listed under the headings General Information, Moving-Coil Transducers, Impulse-Type Transducers, and Transducer Materials. Books, reports, and journal articles are included. Author (TAB)

N69-31339*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
FABRICATION OF SINGLE-CRYSTAL FILM SEMICONDUCTOR DEVICES
Donald B. Sandstrom, inventor (to NASA) and David E. Sawyer, inventor (to NASA) Filed 12 Jun. 1969 11 p
(NASA-Case-ERC-10222; US-Patent-Appl-SN-832603) Avail: CFSTI CSCL 09A

A method is described wherein a single-crystal film is formed on a growth substrate, device fabrication operations are performed on the exposed surface of the film, and the film is thereafter transferred to a nonconductive base. The transfer step includes the chemical dissolution of the growth substrate and may be followed by additional device fabrication operations performed on the second side of the film. By being able to perform such operations on both sides of the single-crystal film, i.e. both prior and subsequent to dissolution of the growth substrate, the process permits the fabrication of devices considerably more intricate than those attainable with present state-of-the-art techniques. NASA

N69-31361*# General Electric Co., Gainesville, Fla. Battery Business Section.
OPTIMIZATION OF DESIGN PARAMETERS FOR SPACECRAFT NICKEL-CADMIUM CELLS CONTAINING RECOMBINATION AND CONTROL ELECTRODES Quarterly Report, Nov. 1968–Jan. 1969
P. R. Voyentzie and G. Rampel Jun. 1969 17 p ref
(Contract NAS5-11547)
(NASA-CR-103298; QR-3) Avail: CFSTI CSCL 09E

This report contains the results of an investigation into factors contributing to the cycle capability of cells containing signal and recombination electrodes. Cycle data have established the following: (1) A minimum negative precharge level of 60% of the total excess negative capacity is required for repetitive cycling to 25% DOD at 40°C with a 1.0 ohm recombination load resistance. (2) The recombination electrodes are functioning to reduce internal cell pressure by a stable amount during later cycles. (3) The signal electrode outputs are showing a loss of sensitivity during 40°C operation. (4) The 2.0 ohm recombination-to-negative load resistance is the choice for 50% DOD-40°C-90 minute orbit operation. (5) Cells are capable of a minimum of 1700 cycles to 50% DOD-40°C during 90 minute orbit periods. Author

N69-31382*# Raytheon Co., Waltham, Mass. Research Div.
CHEMICAL VAPOR DEPOSITED MATERIALS FOR ELECTRON TUBES Final Report, 15 Dec. 1967–14 Dec. 1968
S. R. Steele, H. Schilling, J. Pappis, and J. Simpson Apr. 1969 70 p refs
(Contracts DAAB07-68-C-0156; DA-28-043-AMC-01343(E))
(AD-686342; S-1135; ECOM-0156-F) Avail: CFSTI CSCL 9/1

The objectives of this program include: (a) The investigation of some of the specific applications of currently available CVD materials in electron tubes. (b) The preparation of improved CVD materials which appear to be potentially valuable for future use in electron tubes. Author (TAB)

N69-31459*# Illinois Univ., Urbana. Coordinated Science Lab.
IMPROVING THE DIAGNOSABILITY OF MODULAR COMBINATIONAL LOGIC BY TEST POINT INSERTION
Terry Gene Geddess Mar. 1969 113 p refs
(Contract DAAB07-67-C-0199; Grant NSF GK-1663)
(AD-686385; R-409) Avail: CFSTI CSCL 9/5

To improve module level diagnosability of modular combinational logic circuits, three are described for allocating test points. The first, analogous to the prime implicant covering problem of classical switching theory, requires a large amount of computation but produces a minimum test point set. The second, a graphical worst case analysis, is considerably more economical but produces non-optimum results. The third is a combination of the first two and lies between them in computation required and optimality of results. It is proved that the graphical test point specification algorithm is sufficient to guarantee complete module level diagnosability of the circuit if the test points are used to gain more information on the result of each test. A general graph-theoretic characterization of the non-optimum set of selected test points is given in terms of accessibility properties. A final theorem is proved to show that tests derived on the basis of fault detection only are sufficient for diagnosing the previously troublesome fault classes. An Appendix is given to present an efficient notation useful for analyzing the behavior of a combinational circuit under all allowed fault conditions. The procedure is algorithmic in nature and programmable, and flow charts are given to illustrate one possible implementation. Author (TAB)

N69-31478*# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
MISCELLANEOUS EDDY CURRENT TECHNIQUES
H. L. Libby Jan. 1969 23 p refs
(Contract AT(45-1)-1830)
(BNWL-996) Avail: CFSTI

Several eddy current test techniques which are being developed are discussed. These techniques include controlling the curvature of test coil impedance lift-off loci and stabilizing the temperature of eddy current test coils. An eddy current ultrasonic transducer and the impedance relationship of a solenoid encircling a bar are described. The flow direction of eddy currents in liquid Wood's metal is discussed and an operational test for phase detectors is explained. NSA

N69-31495*# Northeastern Univ., Boston, Mass.
INTERRELATIONS BETWEEN ADVANCED PROCESSING TECHNIQUES, INTEGRATED CIRCUITS, MATERIALS DEVELOPMENT AND ANALYSIS, 1 DECEMBER 1967–30 NOVEMBER 1968
W. B. Nowak, B. L. Cochrun, and W. Carlson 1 Jan. 1969 53 p refs
(Grant NGR-22-011-007)
(NASA-CR-103311) Avail: CFSTI CSCL 09E

To investigate simulated inductances, attention focused on theoretical analysis and experimental verification of circuits suitable for integrated circuits. Active devices considered include gyrators, inductance simulators, mutators, scalors, and two terminal current sources. In studies on microcircuit interconnections, various approaches for quantitatively measuring the interdiffusion between metallic films are assessed. Preliminary findings indicate that the use of optical reflectivity techniques, together with sputter-removal of thin layers, may be a viable method for determining concentration profiles in thin film interdiffusion. Summary data are also included on research pertaining to the hazards associated with laser radiation, and the methods by which laser radiation can be used in medicine and biology. D.L.G.

N69-31533# Gosudarstvennyi Komitet po Ispolzvaniyu Atomnoi Energii, Moscow (USSR). Institut Atomnoi Energii.
RADIOINDUCED DISLOCATIONS IN GERMANIUM TUNNEL DIODES [RADIATSIONNYE NARUSHENIYA V GERMANIEVYKH TUNNELYNYKH DIODAKH]
V. L. Litvinov and N. A. Ukhin 1968 20 p refs In RUSSIAN
(IAE-1658) Avail: AEC Depository Libraries

Descriptions are given of radiation-induced changes in electric characteristics of germanium tunnel diodes irradiated with electrons and neutrons. NSA

N69-31673*# Northeastern Univ., Boston, Mass. Electronics Research Lab.
A STUDY OF MICROMINATURIZED DEVICES FOR BIOASTRONAUTICAL MONITORING OR ANALYSIS Quarterly Report
B. L. Cochrun and J. S. Rochefort 1 May 1969 7 p
(Grant NGL-22-011-024)
(NASA-CR-103323; QR-1) Avail: CFSTI CSCL 09E

Progress in the areas of digital filters, both analog and binary, dc to dc converters capable of working at input voltages as low as 100 millivolts and active circuit synthesis using RC distributed networks is described. Prototypes of the analog digital filter and several dc to dc converters have been breadboarded. Measured characteristics of these circuits support the anticipated results. Consideration of the problem of miniaturization using hybrid techniques was given to the prototype circuits. Author

N69-31660# Lincoln Lab., Mass. Inst. of Tech., Lexington.
LES-6 TRIPLEXER
David R. Bold and Arthur Sotiropoulos 2 Dec. 1968 19 p refs
(Contract AF 19(628)-5167)
(AD-686418; TR-459) Avail: CFSTI CSCL 9/5

This report describes the design and development of the triplexer used in the UHF communications satellite LES-6. The triplexer is a four-port passive microwave structure which provides a common antenna port for simultaneous operation at the transmit, beacon, and receive frequencies, and consists of three-interdigital bandpass filters connected by appropriate lengths of transmission line. A special feature of the transmit filter is its gas-filled hermetically sealed construction, and the details of the mechanical design of the pressure vessel are discussed. Author (TAB)

N69-31696*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Electrical Power Systems.
PASSIVE SOLAR ARRAY ORIENTATION SYSTEM (THERMAL HELIOTROPE) Quarterly Report, 23 Dec. 1968–23 Mar. 1969
Mar. 1969 66 p refs
(Contract NAS5-11637)
(NASA-CR-103300; QR-1) Avail: CFSTI CSCL 09E

Evaluation of the feasibility of thermally actuated sun-tracking systems is presented. These systems use bimetal elements for both sensing and motive power. The project concerns itself with exploring the feasibility of providing solar array suntracking capability through the use of nonelectrical devices. It consists of five main tasks: (1) survey general tracking requirements such as rate and torque requirements, (2) study thermal heliotrope operating mechanisms and develop concepts, (3) analyze thermal properties and provide conceptual designs, (4) fabricate and test models in simulated orbit environments, and (5) document findings and recommendations. The general constraints associated with thermal tracking systems were examined, and typical earth orbiting missions categorized. The possibility of two-axis tracking was also considered. A detailed presentation of the theory of bimetal elements is given with specific formulas for helical bimetal coils. Preliminary thermal analyses have indicated factors influencing response times of the coils and appropriate thermal coatings for them. Several concepts for thermal heliotrope trackers were developed. To date two of these were chosen for model tests in a thermal-vacuum orbit environment. Fabrication of the first models is underway. Author

N69-31786# California Univ., Livermore. Lawrence Radiation Lab.
A HIGH PERFORMANCE, PROGRAMMABLE, 25-kV, 2-A POWER SUPPLY
A. F. Waugh 20 Mar. 1969 13 p Presented at Symp. on Eng. Probl. of Fusion Res., Los Alamos, N. Mex., 8–11 Apr. 1969 Submitted for publication Sponsored by AEC
(UCRL-71570; CONF-690407-15) Avail: CFSTI

The performance, circuit, and construction features of a 50-kW, HV, precision programmable voltage-regulated, dc power supply are described. This system is used as a HV power supply for an ion source. Its high voltage output is applied across the extraction apertures of the ion source to create the high field gradient required to extract an ion beam from the source plasma discharge chamber. The output voltage is adjustable from 200V to 25 kV. The maximum continuous load current is 2 A. The output voltage is regulated to within ±0.05% for ±5% line and ±10% load changes. The peak-to-peak output ripple and noise do not exceed 5 V. An adjustable current limit feature causes the regulator system to instantaneously change from voltage regulating mode to current limiting mode at the current limit set point. It is possible to modulate or program the output HV from a low-level input signal with a gain of 1000. Author (NSA)

N69-31795# Naval Research Lab., Washington, D.C.
THE EFFECTIVE LENGTH AND INTERNAL IMPEDANCE OF THE ELEMENTS OF A RECEIVING ARRAY Final Report
Oliver D. Sledge and Jon D. Wilson Mar. 1969 15 p ref
(AD-686021; NRL-6848) Avail: CFSTI CSCL 9/5

An approximate method has been developed for determining both the effective length and the internal impedance of the individual elements of a receiving array from the currents induced by the incident illumination. With this information and Thevenins theorem, one can easily arrive at the load currents for any type of impedance loading of the array. Author (TAB

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N69-30454 Northwestern Univ., Evanston, Ill.
SEEBECK COEFFICIENT AND ELECTRICAL CONDUCTIVITY MEASUREMENTS ON DOPED AND UNDOPED WUSTITE
William Joseph Hillegas, Jr. (Ph.D. Thesis) 1968 222 p
Avail: Univ. Microfilms: HC $10.15/Microfilm $3.00 Order No. 69-1847

Seebeck coefficient and dc electrical conductivity data were collected at high temperatures (900°-1300°C) on doped and undoped polycrystalline wustite samples whose compositions spanned the phase field. The measurements were made simultaneously on the same sample in an atmosphere of carbon dioxide-carbon monoxide which provided the equilibrium oxygen pressure. The dopants included copper, chromium, titanium, and magnesium. The Seebeck coefficient of undoped wustite is relatively small and

changes sign within the phase field. The p-type portion of the phase field extends from the iron–wustite boundary to wustite compositions which vary from Fe_xO (x = 0.926) at 1300°C to Fe_xO (x = 0.916) at 900°C. The n-type region extends from these compositions to the wustite-magnetic boundary. The grain size of the samples does not influence the values of the Seebeck coefficient. Dissert. Abstr.

N69-30775*# Northeastern Univ., Boston, Mass.
[NORTHEASTERN UNIVERSITY] Quarterly Report
W. B. Nowak, B. L. Cochrun, and W. Carlson 1 Mar. 1968 9 p refs
(Grant NGR-22-011-007)
(NASA-CR-103222; QR-1) Avail: CFSTI CSCL 09C

Progress on active integrated circuits, and metallurgical studies of microcircuit interconnections are reported. A gyrator based on feedback about a unilateral amplifier with an admittance matrix composed of transistors was developed. In the metallurgical studies, effort was directed along three lines: (1) reflectivity measurements, (2) sample preparation, and (3) analytical macroscopic solution of the diffusion problem. F.O.S.

N69-30856# Army Electronics Command, Fort Monmouth, N.J. Electronic Components Lab.
PULSE DURATION EFFECT ON PLASMA RESISTIVITY
John E. Creedon and Sol Schneider *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 316–325 refs (See N69-30833 17-09)
Avail: CFSTI

Further investigation was made of the theory that resistivity of high current discharges is essentially independent of pulse width, until thermal conduction and radiation heating of the wall results in the introduction of impurities. Measurements to determine pulse width dependence were made on three-inch diameter tubes with electrode spacings ranging from 2 to 22 inches. A pulse duration of 56 μsec, as compared to the previous 28 μsec time, was utilized. Results are graphically depicted and analyzed for the per-centimeter resistance of molecular hydrogen at four different pressures. The analytical method used, however, did not include the area determination necessary for converting the results into plasma resistivity. It was nonetheless concluded that neutral gas heating under long pulse conditions can significantly affect plasma resistivity by increasing the electron-atom losses. A.C.R.

N69-30889# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Systems Research Section.
A QUANTITATIVE MEASURE OF THE PASSIVITY AND ACTIVITY OF NETWORKS
M. R. Wohlers Jun. 1969 52 p refs Submitted for publication
(RM-447J) Avail: Issuing Activity

It is shown that a rational basis exists for stating that one network is more "passive" or more "active" than another. A quantitative measure of passivity is developed that assigns to each network a single number that can be calculated in a relatively simple way. This measure is shown to have many of those properties that would be expected on physical grounds. It also allows the study of many fundamental design problems in a rational manner. For example, there would be a basis for designing the maximally lossy loading network that could support oscillations with a given active network. Author

N69-31224# Defense Documentation Center, Alexandria, Va.
MICROMINIATURIZATION (ELECTRONICS), VOLUME 1
Feb. 1969 250 p refs
(AD-684300; DDC-TAS-68-87) Avail: CFSTI CSCL 9/3

The unclassified and unlimited annotated bibliography on microminiaturization (electronics) contains 175 references. The report presents information on design, development, application and manufacturing methods of electronic components, computers and peripheral equipment. The volume is divided into the following subtopics: applications; components, including amplifiers; computers; costs; handbooks/glossary; maintenance; manufacturing methods; packaging; radar; reliability/radiation damage; and solid state physics. This collection is arranged by accession (AD) number sequence in each topical division and contains the following computerized indexes: subject (descriptors), personal author, corporate author, contract, and AD number. Author (TAB)

N69-31377# Institute of Modern Languages, Inc., Washington, D.C. Translation and Interpretation Div.
CRYOGENIC ELECTRIC AC MOTORS
I. D. Kolodaev May 1969 7 p Transl. into ENGLISH of Pribory i Tekhn. Eksperim. (Moscow), no. 6, 1968 219 p
(Contract DAAK02-68-C-0396)
(AD-686433; USAMERDC-T-1962-69) Avail: CFSTI CSCL 9/3

A condensed review is presented of the article Cryogenic Electric A. C. Motors. TAB

N69-31563*# STD Research Corp., Pasadena, Calif.
AN INVESTIGATION OF THE INFLUENCE OF CONTROLLED TURBULENCE ON GASEOUS DISCHARGES
Monthly Progress Report, 12 Mar.–11 Apr. 1969
S. T. Demetriades 20 Apr. 1969 7 p
(Contract NASw-1759)
(NASA-CR-103322; STD-003-66-9; MPR-9) Avail: CFSTI CSCL 09C

Experiments were conducted to measure electrode voltage drops. An apparatus was used which is designed for maintaining a constant current through rectifiers and the electrodes while the electrode spacing is changed. Easy current adjustment was achieved to within a few percent of a constant value. The data were obtained at various electrode spacings across a nitrogen plasma stream with stagnation enthalpy 2080 ± 50 Btu/lb and using a 1-mm-diam wire, 5-mesh screen. The results are presented in a graph and in tables. K.W.

N69-31673# Harry Diamond Labs., Washington, D.C.
EMPIRICAL COMPARISON OF TWO COMPUTER CIRCUIT ANALYSIS PROGRAMS: ECAP AND NET 1
Robert Rosen Mar. 1969 27 p refs
(AD-686277; HDL-TM-69-4) Avail: CFSTI CSCL 9/3

A comparison was made of two computer circuit analysis programs, ECAP and NET-1. Their similarities and differences, advantages and disadvantages, are discussed. A few electronic circuits were selected to be analyzed by each program. The results of each analysis are set forth. Author (TAB)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N69-30952# Airborne Instruments Lab., Deer Park, N.Y.
ANALYSIS OF USER AIRCRAFT FOR EVALUATING VOR AIRWAY PERFORMANCE
Ted Hooten and Rudy Bonitch Apr. 1969 69 p
(Contract FA68 WA-1580)
(SRDS-RD-69-9) Avail: Issuing Activity

Presently VOR transmitters must be routinely checked by special Flight Inspection Aircraft every 120 to 150 days. This project was conducted to see if the routine checks could be replaced by recording performance data of User aircraft along an airway. With sufficient samples, a statistical analysis might then show VOR radial performance to a degree of accuracy such that Special Flight Inspections would only be required at occasional intervals on those navaids shown to be out of tolerance. Tests were conducted on the V139/J121 airway based on the 0.059 degree radial of the Sea Isle VOR. Good data on 300 User aircraft was obtained using the JFK airport radar, a Beacon Video Digitizer at the New York Center, and a special recorder. Special calibrations were made of the SIE 0.059 degree radial and compared with the User performance. Detailed analysis of the latter was made with respect to the effects of aircraft operators, aircraft type, and wind. It is concluded that flight checking of navaids by User aircraft is technically, operationally, and economically feasible. Author

N69-31086# Federal Aviation Administration, Atlantic City, N.J. National Aviation Facilities Experimental Center.

FRICTION EFFECTS OF RUNWAY GROOVES, RUNWAY 4R-22L, JOHN F. KENNEDY INTERNATIONAL AIRPORT, PHASE 2 Final Report

William A. Hiering and Charles R. Grisel Jul. 1969 37 p

(NA-69-8; DS-69-3) Avail: CFSTI

Wet and dry runway friction tests were conducted on concrete Runway 4R-22L at John F. Kennedy International Airport, New York City, using a fixed slip runway friction tester. These tests were conducted to determine if significant friction increases or decreases were generated as a result of transversely grooving the runway surface with 3/8-inch-wide, 45°, V-shaped grooves, having a 1 3/8-inch pitch. Data analysis indicates that at the test speeds of 50 and especially 60 mi/h, an appreciable increase in overall wet runway friction values due to grooving was obtained for these series of tests. In addition, the treatment of the runway surface by the cutting of uniformly spaced grooves markedly smoothed the resultant wet runway friction values. The chemical removal of rubber from the touchdown area of the 22 end of the ungrooved runway substantially improved the friction values of this end compared to those of the untreated 4 end. Author

N69-31131# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.

SOME FLEET ROUTING AND SCHEDULING PROBLEMS FOR AIR TRANSPORTATION SYSTEMS

Amos Levin Jan. 1969 130 p refs

(Contract C-136-66)

(PB-183014; FTL-R-68-5) Avail: CFSTI CSCL 15E

The purpose of the work is to formulate and develop practicable solution methods to some important fleet routing, scheduling and fleet composition problems. These problems arise in the operation of air transportation systems like the operating domestic and international airlines. The minimal single fleet problem is extended to include some extraneous constraints on service frequencies between and at stations. Computational results with examples are provided. The problem of system design with and without a given fleet size is formulated. The problem of decomposition of the system into subsystems, each consisting of a single vehicle type is also formulated in several ways for several considerations. Author (USGRDR)

N69-31586# World Meteorological Organization, Geneva (Switzerland).

PROBLEMS IN THE MEASUREMENT OF RUNWAY VISUAL RANGE (RVR) AND SLANT VISUAL RANGE (SVR) [PROBLEMES RELATIFS A LA MESURE DE LA PORTEE VISUELLE DE PISTE (PVP) ET DE LA PORTEE VISUELLE OBLIQUE (PVO)]

C. Perrin de Brichambaut *In its* Aeron. Meteorology 1969 p 132/138 In FRENCH (See N69-31576 17-20)

Avail: Issuing Activity

Problems related to visibility measurements by an aviator in daylight, as daylight recedes into twilight, and in darkness are presented. The basic concepts of aeronautical optics in judging the horizon and the runway were summarized. Two methods of improved accuracy were described, in which airport ground lights were not required; runway visual range (PVP), and slant visual range (PVO). The theory of PVP, piloting procedures, the telemetry for measuring atmospheric parameters σ, and the conversion of σ to PVP are stated. Technical adaptability to varying ground and meteorological conditions was demonstrated. An international trial of its use was recommended. Transl. by M.H.E.

N69-31659# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

EVALUATION OF SURFACING MATERIALS FOR FIRM BASE TACTICAL AIRFIELDS; BARE BASE SUPPORT

Cecil D. Burns and William N. Brabston Mar. 1969 37 p ref Sponsored by AF

(AD-685826; AEWES-S-69-10) Avail: CFSTI CSCL 1/5

Several types of production and experimental membranes were evaluated to determine their ability to withstand abrasive and tearing effects caused by fighter and heavy cargo aircraft tires during ground operations. Materials tested were WX18, a neoprene-coated membrane, T16 membrane, T1 membrane with a double bituminous surface treatment (DBST), and an 11-mil-thick high-strength steel membrane. The materials were subjected to locked-wheel skid and short-radius turn tests using equivalent F-4C and C-130 aircraft wheel loads. From the results of the study, it was concluded that: (a) WX18 can be used as an expedient surfacing material on an assault airfield with adequate soil strength and will withstand the abrasions caused by ground operations of fighter and heavy cargo aircraft, with minor maintenance required in areas with severe abrasions; (b) with DBST, T16, and 11-mil steel membranes cannot withstand the abrasive effect of locked-wheel skids of fighter aircraft; and (c) the soil strength stipulated by design criteria for assault fields based on static and rolling loads may not be adequate in all cases to provide surfacing that will withstand the increased loads caused by locked-wheel skids. Author (TAB)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N69-30413 Rutgers Univ., New Brunswick, N.J.

A NUCLEAR MAGNETIC RESONANCE STUDY OF THE GAS-LIQUID CRITICAL POINT IN XENON

Barry Pass (Ph.D. Thesis) 1968 232 p

Avail: Univ. Microfilms: HC $10.60/Microfilm $3.00 Order No. 68-17801

A study has been made of xenon in the vicinity of the gas-liquid critical point using the nuclear magnetic resonance free precession technique. The nuclear precession frequency, ν, (and hence the average local magnetic field) of xenon has been measured in the gas above the gas-liquid critical temperature, T_c, and for the coexisting liquid and vapor phases below T_c, in a constant external magnetic field of 7.10 kG. The observed difference between the precession frequencies ν_L and ν_V of the coexisting liquid and vapor phases tends continuously to zero. Dissert. Abst.

N69-30414 Vanderbilt Univ., Nashville, Tenn.
SYMMETRIC FISSION OF A TWO-PARAMETER LIQUID DROP
James Neville Peed Lawrence (Ph.D. Thesis) 1968 146 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-17979

A review of fission theory is presented with attention focused on the liquid-drop model. The present treatment is restricted to only two parameters in order that dynamical calculations may be performed. The family of figures in cylindrical coordinates is expressed. In order to obtain an indication of the accuracy to be expected in the dynamics, calculations of the fission-barrier energy and other saddle-point properties were made. Dissert. Abstr.

N69-30419# Ohio State Univ. Research Foundation, Columbus. Dept. of Mechanical Engineering.
STUDIES OF THE EFFECTS OF ELECTROSTATIC FIELDS ON FLUID FLOWS Interim Report, 1 Oct. 1964–31 Jan. 1969
Henry R. Velkoff Jan. 1969 92 p refs
(Contract DA-31-124-ARO(D)-246)
(AD-684939; IR-10; AROD-4942.12-E) Avail: CFSTI CSCL 20/3

An overall review of studies of electrostatic interactions with fluid flows is presented. Review of prior studies involving ions with free convection, and channel flows is presented along with prior studies of field effects on condensation. The cause of large changes in laminar channel flow with ionization was studied both analytically and experimentally. The changes were determined to result from an electrically induced destabilization of the flow. External ion-flow boundary layer actions were studied and some influence on transition was found. Significant changes to frost formation and flame heat transfer under the action of an impressed E field were found. The possible use of ions injected into a gas stream as a flow diagnostic technique was explored and is considered a very logical area for future exploration. Author (TAB)

N69-30434 Delaware Univ., Newark.
HEAT TRANSFER IN A LAMINAR NON-NEWTONIAN BOUNDARY LAYER FLOW OVER A FLAT PLATE
James Patrick Modrak (Ph.D. Thesis) 1967 148 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 69-1131

The local Nusselt modulus was experimentally determined as a function of Reynolds number for an elastic liquid in laminar flow over a flat plate with an unheated starting length followed by a section with a step-input of constant heat flux. The elastic liquids tested were .05% and .45% solutions. In addition, experimental heat transfer measurements were made using Newtonian fluids of large Prandtl number, namely water, 69.7% and 80.5% corn syrup in water solutions with corresponding Prandtl numbers of approximately 6.0, 355., and 2430, respectively. Heat transfer studies were also conducted at flow rates of 250, 270, and 310 gpm. Free-stream velocities for the very viscous solutions were determined by frame-by-frame analysis of the movies taken of the free-stream flow, while for water a Pitot velocity probe was used. The movies and stream-line photographs taken of the free-stream flow indicated that the free-stream velocity increased along the plate for the heat transfer tests. Dissert. Abstr.

N69-30512*# Scripta Technica, Inc., Washington, D.C.
STATISTICAL CHARACTERISTICS OF TURBULENT TEMPERATURE FLUCTUATIONS IN FLUID FLOWS
V. P. Bobkov et al *In its* Liquid Metals May 1969 p 53–70 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 20D

Experimental data are presented on turbulent flow temperature fluctuations in fluids with highly different thermal conductivities. Specifically, measurements were made using water, mercury, and lead. The intensity of temperature fluctuations, spatial correlation coefficients, scales of temperature disturbance, correlation coefficients, probability distribution, and channel radii were considered in evaluating the various effects on heat transfer and flow. Author

N69-30515*# Scripta Technica, Inc., Washington, D.C.
FLUID DYNAMICS IN AN ANNULAR SPACE WITH LONGITUDINAL RIBS
Yu. D. Levchenko et al *In its* Liquid Metals May 1969 p 100–107 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 20D

Results of an experimental heat transfer study with narrow annuli, both concentric and eccentric, are presented. Experimental test section construction and collected data are given. The applicability of previously recommended calculation methods for velocity distribution and friction factors is shown. Author

N69-30524*# Scripta Technica, Inc., Washington, D.C.
RESISTANCE TO AXIAL FLOW OF FLUIDS PAST ROD CLUSTERS
A. V. Sheynina *In its* Liquid Metals May 1969 p 207–219 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 20D

Experimental data on friction factors for flow through rod clusters are presented, analyzed, and compared with existing correlations. Different types of clusters and configurations were studied. The effect of different spacers and inserts is discussed. Author

N69-30525*# Scripta Technica, Inc., Washington, D.C.
VELOCITY DISTRIBUTION IN A CELL FORMED BY A DENSELY PACKED CLUSTER OF RODS
Yu. D. Levchenko et al *In its* Liquid Metals May 1969 p 220–230 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 20D

The paper presents a thorough analysis of an experimental study of velocity distribution in ducts with noncircular cross-section. Both velocity and shear stress as well as friction factors in ducts simulating a densely-packed rod bundle. Author

N69-30526*# Scripta Technica, Inc., Washington, D.C.
CALCULATION AND EXPERIMENTAL STUDY OF VELOCITY FIELDS IN INTRICATELY SHAPED PASSAGES
M. Kh. Ibragimov et al *In its* Liquid Metals May 1969 p 231–247 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 20D

The present article considers the fluid dynamics of a passage formed by a cluster of three round rods surrounded by a triangular shell. Such duct combines the fluid flow characteristics of rod clusters as well as exposes the effect of the shell on the fluid flow. These characteristics were studied experimentally and considered theoretically. Author

N69-30540*# Scripta Technica, Inc., Washington, D.C.
STUDY OF VELOCITY FIELDS BY THE ELECTROMAGNETIC METHOD
N. N. Turchin et al *In its* Liquid Metals May 1969 p 377–384 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 20D

The present paper presents experimental data on velocity fields in a round tube and an annular channel. Data for laminar and turbulent flows are given and other parameters, such as end effects, are considered. Author

N69-30555 Washington Univ., Seattle.
ACOUSTIC WAVE SCATTERING AND REFRACTION BY INTERNAL WAVES IN A MODEL TANK
Peter Anthony Barakos (Ph.D. Thesis) 1968 325 p
Avail: Univ. Microfilms: HC $14.65/Microfilm $4.20 Order No. 69-1143

An exact theoretical model for the interaction between an acoustic plane wave and a stationary internal wave field of a two-layer fluid is presented. Weber's two-dimensional analog of Helmholtz's integral formula is employed to represent the scattered and the transmitted acoustic fields. The boundary velocity potentials and their normal derivatives are expanded into complex Fourier series. The complex boundary Fourier coefficients are related by a pair of simultaneous, doubly infinite algebraic equations. Generalized Rayleigh scattering and transmission coefficients are found, and exact expressions for the acoustic velocity potentials for the scattered and transmitted fields are given. The principal features of this development are its wide applicability to internal waves of arbitrary amplitude and wavelength and to strongly as well as weakly stratified liquids. Dissert. Abstr.

N69-30572 Northwestern Univ., Evanston, Ill.
PERISTALTIC FLOW IN TUBES AND CHANNELS
Charles Emory Barton (Ph.D. Thesis) 1968 68 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-1793

Three theoretical studies of peristaltic motion are reported. Two analyses were performed to determine the flow of a viscous fluid in a circular tube with a sinusoidal traveling wall disturbance. In the first tube analysis the wall disturbance wavelength was much larger than the average tube radius. In the second tube analysis the disturbance wavelength may be as small as the order of the average radius. Finally, an analysis for viscous flow in a symmatric two-dimensional channel with a sinusoidal short wavelength traveling disturbance on the wall is reported. A computer program is included which gives flow, pressure, and velocity values for the tube with a short wavelength wall disturbance. Dissert. Abstr.

N69-30597 California Univ., San Diego.
THE EXCITATION OF LEE WAVES IN A STRATIFIED FLOW BY SEMI-ELLIPTICAL OBSTACLES
Herbert Eric Huppert (Ph.D. Thesis) 1968 89 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-15683

The stratified shear flow over a two dimensional obstacle of semi-elliptical cross section is considered. The shear flow is assumed to be inviscid with constant upstream values of the density gradient and dynamic pressure (Long's model). Two complete sets of lee-wave functions, each of which satisfies condition of no upstream reflexion, are determined in elliptic coordinates for $\epsilon \geq 1$ and $\epsilon \leq 1$, where ϵ is the ratio of height to half-width of the obstacle. These functions are used to determine the lee-wave field produced by, and the consequent drag on, a semi-elliptical obstacle as functions of ϵ and the reduced frequency (reciprocal Froude number) within the range of stable flow. The reduced frequency at which static instability first occurs is calculated. The Green's functions (point source solutions) for a half space are also determined in elliptic coordinates. Dissert. Abstr.

N69-30630 Arizona State Univ., Tempe.
RADIATION PERTURBED SHOCK WAVES IN AN INVISCID COMPRESSIBLE FLUID
Ronald Dale Evans (Ph.D. Thesis) 1969 212 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 69-1279

An analytical solution for the shock front shape in a perfect gas which is absorbing energy from an external radiating source was derived. The radiation source was assumed to be independent of time and only directly radiating the region of flow behind the shock wave. A perturbation analysis was used to linearize the governing flow equations and boundary conditions. Results are presented for the shape of the shock front profile, as a function of space and time, in a perfect gas with specific heat ratios of 1.4 (air) and 1.5 (argon–carbon dioxide mixture with a respective mass ratio of eight to one). The absorption coefficient of high temperature air was measured over the spectral range 2300Å to 3000 Å and the temperature range 2000° to 4350°K. The results obtained were reduced to a density at one atmosphere and a temperature of 300°K. Dissert. Abstr.

N69-30698 California Inst. of Tech., Pasadena.
STOKES FLOW PAST A THIN SCREEN, PART 1. VISCOUS FLOWS PAST POROUS BODIES OF FINITE SIZE, PART 2
Cheng-chung Shen (Ph.D. Thesis) 1968 152 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-536

The slow, viscous flow past a thin screen is analyzed based on Stokes equations. The problem is reduced to an associated electric potential problem as introduced by Roscoe. Alternatively, the problem is formulated in terms of a Stokeslet distribution, which turns out to be equivalent to the first approach. Special interest is directed towards the solution of Stokes flow past a circular annulus. The problem is finally reduced to solving a Fredholm integral equation of the second kind. A set of boundary conditions is formulated to be prescribed at the interface between a viscous flow region and a porous medium so that the problem of a viscous flow past a porous body can be solved. General macroscopic equations of motion for flow through porous media are first derived by averaging Stokes equations over a volume element of the medium. Dissert. Abstr.

N69-30728*# IIT Research Inst., Chicago, Ill.
TURBULENCE IN THE MIXING REGION BETWEEN DUCTED COAXIAL STREAMS
J. J. Leithem, R. A. Kulik, and H. Weinstein Washington NASA Jul. 1969 48 p refs
(Grant NsG-684SC)
(NASA-CR-1335) Avail: CFSTI CSCL 20D

An experimental investigation of both homogeneous and heterogeneous compound ducted jets is presented for axially symmetric coflowing streams. The flow system considered in one of a circular 3 inch inner stream issuing into a circular 6 inch, faster moving, outer stream. Air was used for the outer stream gas and both air and Freon-12 were used for the inner jet. This gave density ratios of 1 and 4, inner to outer stream, respectively. The velocity ratio was varied from 4.19 to 30.0 for both cases with absolute velocities of 1.5 to 40 ft/sec. All data were taken with a constant temperature hot wire anemometer system. Average velocity, radial and axial turbulence intensity profiles both near and far downstream are presented for the homogeneous cases. Average velocity, density and axial turbulence intensity profiles as well as mass holdup data both near and far downstream are presented for the heterogeneous cases. The ratio of axial to radial turbulence intensity was about 1.5, the same as found for unconfined coaxial flow. For the higher density ratio cases, the inner stream integrity was maintained better than for the homogeneous cases. The flow system was found to be one of combined wake-coaxial flow with possible backflow. Author

N69-30732 Northwestern Univ., Evanston, Ill.
QUESTS INTO THE STABILITY OF STRUCTURAL SYSTEMS INTERACTING WITH FLUID JETS

Walter Theodore Feldt (Ph.D. Thesis) 1968 77 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-1829

This study is divided into two distinct, but related, parts. The first is concerned with the theoretical and quantitative experimental determination of critical loads which separate stable from unstable states of equilibrium of a mechanical system subjected to action of an impinging fluid jet. It was found that the type of loss of stability is determined by the properties of the surface upon which the jet impinges. The second part of this study is concerned with the determination of the critical flutter parameter for a uniform, cantilevered, non-swept airfoil under the action of an end thrust and mass, in a high-density, low-speed fluid flow. Results are presented showing that increasing the end thrust is a destabilizing effect while increasing the mass tends to stabilize the system.
Dissert. Abstr.

N69-30734 Minnesota Univ., Minneapolis.
THE EFFECT OF PRESSURE ON THE RADIAL DISTRIBUTION OF LIQUID SODIUM
Marianne Budke-Daeg (Ph.D. Thesis) 1968 245 p
Avail: Univ. Microfilms: HC $11.05/Microfilm $3.20 Order No. 68-17728

X-ray diffraction measurements were made on liquid sodium at various pressures in order to determine the effect of constant volume at temperatures between the melting point and 190°C on the radial distribution function. Measurements were done under constant volume condition calculated from the isothermal compressibility data for liquid sodium, and also at pressures differing from the constant volume condition. No significant intensity change of the directly measured diffraction curves was observed at constant temperatures and up to 19,000 psi deviation from constant volume pressure. The raw intensity data were corrected for absorption in a partially exposed cylindrical cell, polarization, incoherent scattering effects and eccentricity error. The correct intensity $i(\theta)$ was converted to $i(s)$ with $s = 4\pi\sin\theta/\lambda$ and used as input data for the calculation of the Fourier transform $4\pi r^2\zeta.(g(r)-1)$. A final correction for the normalization constant, directly applicable to the Fourier transform program, was added.
Dissert. Abstr.

N69-30757# Mound Lab., Miamisburg, Ohio.
CONTINUOUS FLOW MEASUREMENTS OF THERMOSETTING PLASTICS WITH THE OSCILLATING DISK RHEOMETER
R. M. Brodbeck and L. W. Hartzel 7 Mar. 1969 18 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1550) Avail: CFSTI

An oscillating disk rheometer is being used to measure the flow properties and cure rate of thermosetting plastics. With this instrument, flow was evaluated for filled and unfilled epoxies, phenolics, silicones, and polyesters. The oscillating disk rheometer is capable of about 95% precision and yields a continuous record from initial to final stiffness during thermosetting. In addition to being a research tool, the oscillating disk rheometer provides a means of rapid quality control testing of thermosetting plastics.
Author (NSA)

N69-30768# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
AN EXPERIMENTAL STUDY OF THE MODE OF EMPLACEMENT OF LAVA FLOWS
Barry W. Bullard (M.S. Thesis) Jun. 1968 104 p refs
(AD-673361; GSF/MC/68-2) Avail: CFSTI CSCL 8/7

The mechanism of lava low emplacement was studied using a model material whose physical properties permitted similar but slightly distorted scaling of an acidic magma. The material was extruded at a single temperature and approximately constant rate down slopes of known dip. The length as a function of time, final dimensions, and typical cross sections of the models were measured for different slopes and volumes. The models suggest explanations for pressure ridges and levees observed on natural flow. Quantitative results, reproducibility, and model distortion are presented and discussed.
Author (TAB)

N69-30769 California Inst. of Tech., Pasadena.
STEADY SURFACE WAVE PATTERN IN A SHEAR FLOW
Joseph P. Lau (Ph.D. Thesis) 1968 85 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-521

The steady surface wave patterns created by small concentrated disturbances acting on a non-uniform flow of a heavy fluid were studied. The initial value problem of a point disturbance in a primary flow having an arbitrary velocity distribution (U(y),0,0) in a direction parallel to the undisturbed free surface is formulated. A geometric optics method and the classical integral transform method are employed as two different methods of solution for this problem. Whenever necessary, the special case of linear shear (i.e., $U(y) = U_0(1+\epsilon y)$) is chosen for the purpose of facilitating the final integration of the solution. The asymptotic form of the solution obtained by the method of integral transforms agrees with the leading terms of the solution obtained by geometric optics when the latter is expanded in powers of small ϵ.
Dissert. Abstr.

N69-30773 Illinois Univ., Urbana.
KINETIC STUDY OF THE HYPERSONIC FLOW PAST THE LEADING EDGE OF A FLAT PLATE
Ratab Jaber El-Assar (Ph.D. Thesis) 1968 58 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-1336

An attempt is made to solve the two-dimensional Boltzmann equation. The form of the distribution function is assumed apriori as the sum of two half range Maxwellian distribution functions containing three unknown parameters. This approach is an extension of the Mott–Smith bimodal model for the normal shock wave problem. The three unknowns in the distribution function are determined by satisfying three moments of the Boltzmann equation. Order of magnitude approximations (e.g., the hypersonic approximations) are subsequently employed in the analysis to make decoupling of the moment equations possible. The resulting equations are then solved using the Maxwell slip boundary condition, after adjusting it to the present model, in conjunction with the boundary conditions for the half-range densities.
Dissert. Abstr.

N69-30939# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
DISCHARGE OF GAS JETS INTO A SUPERSONIC STREAM FROM ORIFICES IN THE LATERAL SURFACE OF A BODY
A. I. Zubkov et al. 5 Feb. 1969 15 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. I: Mat. i Mekhan. (Moscow), no. 5, 1968 p 66–72
(Contract NOw-62-0604-c)
(AD-685073; APL-CLB-3-T-576) Avail: CFSTI CSCL 20/4

An investigation was made of supersonic (M = 1, 2.82, 3) jets injected into a supersonic flow from orifices of different diameters in a flat plate. The geometric characteristics of the separated flow zone and the configuration of shocks ahead of and in a jet are studied. The boundary layer was turbulent.
Author (TAB)

N69-30956# Hydronautics, Inc., Laurel, Md.
VELOCITY-DISTRIBUTIONS IN STRAIGHT RECTANGULAR CHANNELS
Chin-lien Yen Jul. 1968 33 p refs
(Contract DI-14-01-0001-1572)
(PB-182959; TR-801-3; W69-03703) Avail: CFSTI CSCL 20D

Experimental data for velocity-distributions in turbulent flow in straight rectangular channels with varying width-depth ratios and boundary roughnesses were collected from various sources and analyzed in an attempt to produce a generalized velocity-distribution for this type of channel flow. Dimensional analysis is applied in search for possible parameters to generalize the velocity-distributions in the outer-law region where viscosity plays no role in determining the flow pattern. Author (USGRDR)

N69-31003# Royal Aircraft Establishment, Farnborough (England).
SOME RECENT RESEARCH RESULTS IN THE FIELD OF FLOWS WITH ENERGY SUPPLY [EINIGE NEUERE FORSCHUNGSERGEBNISSE AUF DEM GEBIET DER STROEMUNGEN MIT ENERGIEZUFUHR]
A. W. Quick Feb. 1969 62 p refs Transl. into ENGLISH from ICAS Paper No. 68-01
(RAE-Lib-Trans-1345) Avail: CFSTI

Theoretical results are reported for energy supplies in propulsion systems, stability of flows with energy supply in subsonic and supersonic flows, and some problems of the fuel supply. The results of investigations in reaction kinetic processes and the supply of electric energy to flowing gases are also presented. E.H.W.

N69-31048# California Univ., Berkeley. Lawrence Radiation Lab.
OSCILLATING-JET MEASUREMENT OF DYNAMIC LIQUID-LIQUID INTERFACIAL TENSION
Sugihiko Tada (Ph.D. Thesis), Alfred E. Vandegrift, and Theodore Vermeulen Dec. 1968 164 p refs
(Contract W-7405-ENG-48)
(PB-182946; UCRL-18629) Avail: CFSTI CSCL 20D

The oscillating-jet technique has been used previously for measuring the surface tension between a gas and a liquid. Here it is extended to the measurement of the interfacial tension between two immiscible liquids. This work was undertaken to establish a hydrodynamical theory for the oscillating jet, so as to allow this technique to be used to indicate interfacial concentrations in liquid-liquid systems undergoing mass transfer. The mathematical theory of Bohr for the gas-liquid case is extended to the liquid-liquid case to give an exact but implicit analytical solution, and a simple correction multiplier to the Rayleigh formula has been developed to give an explicit representation of the exact solution. USGRDR

N69-31089# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECTIVENESS OF A GAS CURTAIN ON A TUBULAR SURFACE
E. P. Volchkov et al 16 Dec. 1968 13 p refs Transl. into ENGLISH from Zh. Prikl. Mekh. i Tekhn. Fiz. (Moscow), no. 1, 1968 p 115–120
(AD-686231; FTD-HT-23-658-68) Avail: CFSTI CSCL 20/4

Experiments were made to determine the efficiency of cold gas jets used for protecting duct walls from the heat transferred from a main gas stream. Cold air and air preheated to 55-100C were used as the hot and cold gases. The cold air was injected at 1-6 m/sec through a slit parallel to a corrugated wall consisting of ebonite cylinder sections. These sections were mounted on a panel and placed in the 150-mm-wide rectangular test section. Velocity and temperature profiles were measured at the inlet and in various cross sections of the test section. The data were correlated in terms of the main gas flow viscosity, wall temperature, Reynolds number, and distance from the inlet. The efficiencies of cold gas jets for protecting smooth and corrugated walls are compared. Author (TAB)

N69-31088# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.
THE EFFECT OF A SHEAR LAYER ON PLANE WAVES OF SOUND IN A FLUID
E. W. Graham and B. B. Graham Nov. 1968 52 p refs
(D1-82-0823) Avail: Issuing Activity

Available theory indicates that plane waves of sound are reflected and refracted to an interface of relative motion (a velocity discontinuity) between two regions of fluid. If the relative velocity is sufficiently great three types of reflection occur, ordinary, total and amplified, depending on the incident wave angle. In the amplification regime theory predicts resonances. Here the velocity discontinuity is replaced by a transition layer of finite thickness separating the two fluid regions. This layer is approximated by two equal velocity discontinuities and by a linear velocity profile shear layer. For one example in the regime of ordinary reflection the effects of thickness are negligible for thicknesses up to 1/10 of the incident wavelength. For the chose examples in amplified reflection extreme reductions in transmission and reflection coefficients occur for a thickness as little as 1/50 of a wavelength. The two models approach total reflection and zero transmission at larger thicknesses. These effects are produced by layers of fluid traveling at or near the apparent wave speed parallel to the shear layer. Author

N69-31103# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
A MODIFIED MOMENT METHOD FOR SHOCK STRUCTURE PROBLEM
Prem K. Khosla Feb. 1969 22 p refs
(Contract Nonr-839(34))
(AD-684890; PIBAL-69-5) Avail: CFSTI CSCL 20/4

The structure of a shock wave in a monatomic gas has been the subject of investigation by many authors. In this problem there are two relevant mean free paths, viz., the length over which upstream distribution is altered by collisions and another length over which downstream particle distribution is changed through collisions. Appropriate distribution functions over these length scales are postulated and a moment method to solve the Boltzmann equation is described to solve the shock wave structure problem. For strong shocks the results agree with those of Mott-Smiths theory while for weak shocks, the results are in agreement with Navier-Stokes and other approximate solutions. Author (TAB)

N69-31108# California Univ., Berkeley. Div. of Applied Mechanics.
ON BASIC EQUATIONS FOR MIXTURES
A. E. Green and P. M. Naghdi Feb. 1969 24 p refs
(Contract N00014-67-A-0114)
(AD-684885; AM-69-4) Avail: CFSTI CSCL 20/4

The basic equations in the theory of mixtures as developed and used by several authors are re-examined in detail with special reference to definitions of quantities associated with the mixture. The problem of a mixture of any number of ideal fluids is also reconsidered. Author (TAB)

N69-31115# Israel Inst. of Tech., Haifa. Faculty of Civil Engineering.
STUDIES IN RHEOLOGY AND HYDRODYNAMICS OF DILUTE POLYMER SOLUTIONS
Michael Poreh, Hillel Rubin, and Chaim Elata Mar. 1969 111 p refs
(Pub-128) Avail: CFSTI

It is found that no linear elastoviscous fluid model can predict consistently all the observed non-Newtonian phenomena of polymer solutions and their flow characteristics. Experimental and

theoretical results are presented on studies of turbulent flow of dilute polymer solutions through an annulus. Measurements of the dynamic response of flowing polymer solutions with a vibrating torsional quartz crystal are presented. The dynamic elastoviscous response is found to be independent of the flow characteristics and shear rates. The effect of polymer injection into a developing boundary layer at the inlet section of a pipe was investigated. Frictional drag reduction measurements are presented and analyzed. Reduction of local friction coefficients is of the order of 70 percent; however, energy losses in the injection region decrease the total drag reduction. Drag reduction and degradation tests of several polymer solutions are presented. Author

N69-31142# Centre National de la Recherche Scientifique, Meudon (France). Laboratoire d Aerothemique.

CALCULATION OF TWO-DIMENSIONAL MOLECULAR FLOW ABOUT A CONVEX BODY WITH PLANE FACES [CALCUL DE L ECOULEMENT MOLECULAIRE LIBRE BIDIMENSIONNEL AUTOUR D UN OBSTACLE CONVEXE A FACES PLANES]

H. Viviand and F. Legay Sep. 1968 60 p refs In FRENCH *Its* CNRS Publ. No. 330

(Rept-68-5; B-867) Avail: CSFTI

The velocity and density field for molecular flow about convex bodies with plane faces were calculated. Numerical applications were made to the case of a flat plate at 0°, 30°, 60°, and 90° incidence and for molecular velocity ratios of 2, $\sqrt{2.8}$ (corresponding to a Mach number 2 for a diatomic gas), and 10. Density field analysis resulted in a Maxwellian series of density functions. The results obtained for a flat plate at incidence can easily be applied to calculate the case of a dihedral. Author

N69-31171 Safety in Mines Research Establishment, Buxton (England).

THE ACCURACY OF SAMPLING PROBES IN VERY THIN METHANE LAYERS

S. J. Leach and A. Slack 1967 11 p refs

(Rept-252) Copyright. Avail: Issuing Activity 3s 6d

When a sampling probe is introduced into a methane roof layer, small flow disturbances occur which can reduce the concentration of methane sampled by the probe. The reasons for this effect are discussed, and experiments with methane layers and nitrous-oxide layers which show that the sampled concentration is reduced by a negligible amount except for very thin layers are described. However, in very thin layers with steep concentration gradients certain types of sampling probes may lead to large errors; tests with several types of probe are described. The effect of the probe sampling rate was investigated and shown to be negligible up to 1 liter min. A parallel-disk probe was developed which is independent of flow direction and gives concentrations close to the true values. Author

N69-31194# Hydronautics, Inc., Laurel, Md.

CALCULATION OF THE DISPERSION COEFFICIENT IN STRAIGHT PRISMATIC STREAMS

C. L. Yen and C. Elata Jun. 1968 36 p refs

(Contract DI-14-01-0001-1572)

(PB-182961; TR-801-1) Avail: CFSTI CSCL 20D

A general approximate expression for the dispersion coefficient of flow in a straight prismatic conduit is developed. Dispersion coefficients are calculated for flow in a straight pipe as a function of velocity distribution and friction coefficient neglecting the laminar sublayer. The results show the effect of friction coefficient on the dimensionless dispersion coefficient. Author (USGRDR)

N69-31207# Hydronautics, Inc., Laurel, Md.

A DISCUSSION OF THE DISPERSIVITY TENSOR FOR A TURBULENT UNIFORM CHANNEL FLOW

G. Dagan Jun. 1968 36 p refs

(Contract DI-14-01-0001-1572)

(PB-182960; TR-801-2) Avail: CFSTI CSCL 20D

The turbulent mixing of a pollutant in a stream flow is described with the aid of the dispersivity tensor. In a two-dimensional flow only the radial dispersivity coefficient is significant and is usually determined through the Reynolds analogy. The analogy is extended to a three-dimensional uniform flow. It is shown that the mixing length theory leads to the representation of the dispersivity tensor in the terms of only two distinct coefficients: one representing mixing normal to isovels which may be found through Reynolds analogy and a lateral dispersivity coefficient which has to be determined from dispersivity measurements. Author (USGRDR)

N69-31219# Harvard Univ., Cambridge, Mass. Engineering Sciences Lab.

THE CURRENT STATUS OF STATISTICAL MODELS IN KINETIC THEORY

D. G. M. Anderson, H. Baum, and M. Krook Nov. 1968 14 p

(Grant NSF GK-65)

(TR-32) Avail: Issuing Activity

Some general approaches to the formulation of a hierarchy of statistical kinetic equations are described. Equations describing gases ranging in complexity from a simple gas with no internal degrees of freedom to a multicomponent reacting mixture are presented. Author

N69-31222# Case Western Reserve Univ., Cleveland, Ohio. Div. of Fluid Thermal and Aerospace Sciences.

AN EXPERIMENTAL INVESTIGATION OF NATURAL CONVECTION IN A HORIZONTAL CYLINDER

Irving H. Brooks and Simon Ostrach Jan. 1969 68 p refs

(Grant AF-AFOSR-1485-68)

(AD-685176; FTAS/TR-69-38; AFOSR-69-0174TR) Avail: CFSTI CSCL 20/4

The study deals with an experimental investigation into the natural convection inside a horizontal cylinder. The fluid, geometry, and thermal boundary condition were chosen so as to have a high Prandtl number and unit order Grashof number. The thermal boundary condition was established by imposing temperatures at two points, 180 degrees apart, on the circumference of the cylinder. The resulting boundary condition for the full 360 degrees was found experimentally and is presented. The apparatus was constructed so that the entire cylinder could be rotated. This was done so that the diameter containing the two imposed temperatures could vary from being horizontal to being vertical. In this way an arbitrary heating angle was incorporated into the boundary condition. Temperature profiles and streamline patterns were observed at steady state for various values of this heating angle and for various initial conditions. For some cases, velocity profiles were also plotted. It was found that the interior core of fluid was thermally stratified when the diameter containing the two imposed temperatures was horizontal. The flow occurred primarily in the region close to the cylinder wall. The cylinder was rotated so that the diameter containing the two imposed temperatures made an angle with the horizontal. Author (TAB)

N69-31232 Safety in Mines Research Establishment, Buxton (England).

THORETICAL STUDY OF LONGITUDINAL DIFFUSION, INTO A ONE-DIMENSIONAL TURBULENT FLOW, OF MATTER FROM A SOURCE MOVING AT THE FLOW VELOCITY

B. FLETCHER AND S. J. Leach 1967 10 p refs

(Rept-251) Copyright. Avail: Issuing Activity 2s 9d

This is a theoretical investigation into the dispersion of gas emitted into a turbulent stream of air in a pipe, from a source moving at the mean stream velocity. A virtual coefficient of diffusion is used to combine the effects of velocity variation across the pipe and turbulent diffusion, and the mean concentration over a cross-section is derived as a function of time of emission, distance from the source, emission rate, cross-sectional area, fluid density and a friction coefficient. A possible application of this investigation is to the build-up of toxic gas around a diesel locomotive moving along a mine roadway with the velocity of the air stream. Author

N69-31234# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.

TIME DEPENDENT VISCOUS INCOMPRESSIBLE FLOW PAST A FINITE FLAT PLATE

Yih-Ho Pao and R. J. Daugherty Jan. 1969 45 p refs

(AD-686318; D1-82-0822) Avail: CFSTI CSCL 20/4

The flow is started suddenly with a constant velocity and is parallel with the plate. This simple flow configuration is used to compare the accuracy and the speed of various numerical methods and to examine the effect of the far field boundary conditions and the variable mesh size on the flow. The governing Navier-Stokes equations are expressed in terms of vorticity and stream function. The (parabolic) vorticity equation is approximated by two finite difference methods. The (elliptic) stream function equation is approximated by two relaxation schemes. The details of the flow field around the flat plate are computed for Reynolds number equal to 4 and 993. One of the interesting results is that the velocity at the outer edge of the boundary layer exceeds that of the free stream and the maximum velocity overshoot is 9.5% at Re = 4 and 5.4% at Re = 993. The implicit alternating direction method is two to three times faster than the explicit method. Author (TAB)

N69-31249# Technische Hogeschool, Eindhoven (Netherlands). Afdeling der Elektrotechniek.

MHD POWER CONVERSION EMPLOYING LIQUID METALS

J. W. M. A. Houben and P. Massee Feb. 1969 34 p refs

(TH-69-E-08) Avail: CFSTI

The work described was performed in the field of MHD generation of electricity by means of liquid metals. It is shown that the study of two-phase flows is essential in this topic of research. Two types of generators which can be utilized with liquid metals were studied. The results are described. A short survey of the prospects of other liquid metal systems, which emerge from a study of the literature, is given. Finally, conclusions are drawn concerning possibilities for further investigation. Author

N69-31274# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.

LIQUID VELOCITY MEASUREMENT BY ELECTRONIC DETECTION OF PARTICLE IMAGES

William B. Clarke 1 Oct. 1968 33 p refs

(Contract Nonr-3963(10))

(AD-684822) Avail: CFSTI CSCL 20/4

Tracer particles are frequently used to study fluid flows. This report describes experiments with an electronic detection system for tracer particles, which it was thought would provide a rapid readout of velocity. The light scattered from the moving particles was passed through a grid, in such a way that the frequency of modulation by the grid was found to vary with the latex particle size, from 1 for 1 particles, to 10 for 10 particles. Bandwidths were wider than expected, suggesting that out of focus particles were being detected, which would prevent the use of this method for studying turbulent flows. Author (TAB)

N69-31289# Nielsen Engineering and Research, Inc., Palo Alto, Calif.

INHIBITION OF FLOW SEPARATION AT HIGH SPEED. VOLUME 1: SUPERSONIC TURBULENT BOUNDARY LAYERS Technical Documentary Report, Oct. 1966–Sep. 1968

Larry L. Lynes, Jack N. Nielsen, and Frederick K. Goodwin Mar. 1969 68 p refs

(Contract F33615-67-C-1096)

(AD-686443; NEAR-TR-5-Vol-1; AFFDL-TR-68-119-1) Avail: CFSTI CSCL 20/4

The method of integral relations was successfully applied to compressible nonadiabatic turbulent boundary layers on a flat plate. The theory is designed to accept any desired eddy-viscosity model. A particular eddy-viscosity model was incorporated into the method, and the equations were programmed for application to a flat plate with no pressure gradient. The variations of the skin-friction coefficient with Reynolds number, Mach number, and temperature ratio were calculated using this program, and the results are in good accord with similar results calculated by the Spalding-Chi method and the Rubesin T method. An analysis was made to predict to what extent turbulent separation of the free-interaction type can be inhibited by means of surface cooling. It was observed experimentally that free-interaction is applicable to separated turbulent boundary layers up to the separation point or beyond. The free-interaction model used in the analysis is based on adding the boundary-layer displacement thickness to the actual body dimensions in calculating the induced pressures. The critical temperature ratios calculated on this basis are generally greater than adiabatic wall temperature except in the supersonic range up to a Mach number approaching 3, where moderate cooling is required to inhibit separation. Author (TAB)

N69-31290# Nielsen Engineering and Research, Inc., Palo Alto, Calif.

INHIBITION OF FLOW SEPARATION AT HIGH SPEED. VOLUME 2: CALCULATION OF NONADIABATIC LAMINAR BOUNDARY LAYERS Technical Documentary Report, Oct. 1966–Sep. 1968

Frederick K. Goodwin, Jack N. Nielsen, and Larry L. Lynes Mar. 1969 90 p refs

(Contract F33615-67-C-1096)

(AD-686444; NEAR-TR-8-Vol-2; AFFDL-TR-68-119-2) Avail: CFSTI CSCL 20/4

The purpose of the report is to extend previous analytical work of the authors to colder walls by including a term of higher order in the assumed total temperature profile. The analysis is developed for both flat-plate-wedge and cylinder-flare configurations. The effect of this higher order term on the theoretical critical temperature ratio, found in the earlier work for separation of the free-interaction type, is discussed. At the beginning of interaction the boundary layer is assumed to be of the Blasius type and the flow at the edge of the boundary layer throughout the interaction is assumed to be isentropic. Comparisons between the theoretical calculations and experiments are presented for both two-dimensional and axisymmetric configurations. The ratio of wall temperature to free-stream stagnation temperature varies from 1.0 to 0.2. The

agreement between the theoretical and experimental pressure distributions is considered good. A comparison between theoretical and experimental heat-transfer distributions indicates only fair agreement. Author (TAB)

N69-31309# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies
CRITICAL EVALUATION OF TRANSITION FROM LAMINAR TO TURBULENT SHEAR LAYER WITH EMPHASIS ON HYPERSONICALLY TRAVELING BODIES Final Report, 10 Apr. 1967–30 Aug. 1968
Mark V. Morkovin Wright-Patterson AFB, Ohio AFFDC Mar. 1969 154 p refs
(Contract F33615-67-C-1662)
(AD-686178; RIAS-TR-68-13C; AFFDL-TR-68-149) Avail: CFSTI CSCL 20/4

The review report represents an attempt to evaluate critically the available data on high-speed boundary layer transition to turbulence and to interpret the apparent agreements and contradictions within some rational framework. Special attention was paid to the more documentable discrepancies between reported results as touchstones of conceptual models and instability theories. Experiments with microscopic information are used as backbone of conceptual models, both linear and nonlinear. Linear instability results are used as a point of departure for the examination of current controversial questions of transition reversal with cooling, unit Reynolds number effect, effect of aerodynamic noise in supersonic wind tunnels, et. Author (TAB)

N69-31310*# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
INVESTIGATIONS AND ANALYSIS OF FLOW PHENOMENA OF SECONDARY MOTIONS IN AXIAL FLOW INDUCERS Progress Report, Nine Month Period Ending 31 Mar. 1969
B. Lakshminarayana Jun. 1969 64 p refs
(Grant NGL-39-009-007)
(NASA-CR-103291) Avail: CFSTI CSCL 20D

A brief summary of investigations of the flow phenomena in a four-bladed inducer are presented. Specific summaries are given on the following topics: (1) stationary probe measurements; (2) hot wire measurements to derive the three-dimensional flow field at the exit of the inducer; (3) measurements of the annulus wall and hub wall static pressures at various axial locations of the inducer; (4) flow visualization experiments to determine the angle of the limiting streamline at various radial and chordwise locations of the blades; and (5) complete flow survey of the relative flow. K.R.G.

N69-31327*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
ONE-DIMENSIONAL FLOW OF A MAGNETIZED FLUID [ODNOMERNOYE TECHENIYE NAMAGNICHENNOY ZHIDKOSTI]
Ye. I. Yantovskiy Washington NASA Jul. 1969 11 p refs Transl. into ENGLISH from Magnitn. Gidrodin. (Latvian SSR), v. 4 1968 p 3–9
(Contract NASw-1692)
(NASA-TT-F-12404) Avail: CFSTI CSCL 20D

The one-dimensional flow of a conducting inviscid compressible fluid in a channel in the presence of transverse electric and magnetic fields at arbitrary Reynolds magnetic numbers is discussed. Steady velocity flows where the magnetic permeability is inversely proportional to the magnetic field or decreases linearly as the temperature approaches the Curie point are discussed specifically. Author

N69-31358*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DRAG REDUCTION DUE TO GAS INJECTION THROUGH VARIOUS DISCRETE SLOTS ON A THREE-DIMENSIONAL WING AT MACH 2.01
Russell B. Sorrells, III, K. R. Czarnecki, and Lorraine F. Satchell Washington Jul. 1969 45 p refs
(NASA-TN-D-5307) Avail: CFSTI CSCL 20D

Force measurements were made of the drag reduction due to the injection of gas into a turbulent boundary layer through discrete slots of various sizes and configurations on a three-dimensional semispan wing at a Mach number of 2.01. Air, helium, and Freon were injected, transition was fixed, and the tests were conducted at Reynolds numbers, based on the mean geometric chord, ranging up to 4.48×10^6. The theoretically estimated and measured skin-friction reductions are compared. It was found that for the supersonic transport and for the slot drags incurred in this investigation, engine bleed air does not provide sufficient mass flow to warrant the use of air injection for drag reduction over an entire wing span. However, if the engine bleed air is injected only over the nacelles, it appears possible at Mach 2.0 to achieve a drag reduction equivalent to from 9 to 35 percent of the nacelle skin friction, the percentage depending on the amount of bleed plenum pressure energy that is used for thrust. Greater drag reductions were obtained by injecting helium into the boundary layer than by injecting air or Freon. In the design of an ejection system, the slot drag and the available thrust rather than the skin-friction reduction should be optimized, and the possible lift interference effects of an injected gas should be considered in selecting the location of an ejection slot or nozzle. Author

N69-31368# Aro, Inc., Arnold Air Force Station, Tenn.
SAMPLING PROBE FOR INSTANTANEOUS MASS SPECTROMETRIC ANALYSIS OF RAREFIED ENTHALPY FLOW Final Report, 1 Jul. 1966–30 Sep. 1968
R. E. Dix AEDC Apr. 1969 44 p refs
(Contract F40600-69-C-0001)
(AN-686406; AEDC-TR-69-37) Avail: CFSTI CSCL 20/4

An aerodynamically shaped probe was developed for instantaneous mass spectrometric analyses of gas samples taken from low density, high enthalpy, hypersonic flows. The requisite .00001 torr operating pressure for a quadrupole mass spectrometer mounted in the water-cooled probe was established and maintained by a liquid-hydrogen cryopump. During an initial series of 5-min tests, the detected composition of an arc-heated airflow with a stagnation condition of approximately 10 atm at 3000K agreed well with a nonequilibrium flow expansion calculation. Author (TAB)

N69-31388*# Techtran Corp., Glen Burnie, Md.
HYPERSONIC AERODYNAMIC FLOW AROUND SLENDER CONES AT HIGH INCIDENCE, PART 1B
R. Brun et al Washington NASA Jul. 1969 21 p refs Transl. into ENGLISH from the publ. "Institut de Mecanique des Fluides de Marseille, Universite d'Aix Marseille" 1968 p 27
(Contract NASw-1695)
(NASA-TT-F-12314) Avail: CFSTI CSCL 20D

Interest in the study of supersonic and hypersonic flow around circular cones placed at an angle with respect to the direction of free flow has led to quite a few studies. While these have concentrated on certain important points, they have not, however, completely solved the problem of the configuration of the flows itself and its influence on the measured parameters. While this study does not furnish a final solution to the problem, it throws light on the fundamental aspects of flow under a high temperature, free hypersonic flow, and boundary layer flow, as a result of highly accurate and precise measurements of heat flow along walls. These measurements are related to an interpretation

which reasonably predicts the phenomena, particularly in the vicinity of the plane of symmetry where the structure of flow at small angles of incidence and the influence of layer separation at high angles of incidence are examined. Author

N69-31399# Lockheed Missiles and Space Co., Palo Alto, Calif.
PHYSICAL FLOW PECULIARITIES IN THE SEPARATION DOMAIN DURING THREE DIMENSIONAL BOUNDARY-LAYER SHOCK INTERACTION
V. S. Avduevskii et al [1969] 10 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 1, 1967 p 25–33
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Three-dimensional flow in the plane of symmetry of the domain of boundary layer interaction with a shock originating ahead of an obstacle mounted on a plate is examined in a supersonic flow. Pressure distributions are measured, shadowgraph and Toepler photographs, and pictures of the flow on the surface are obtained upon superposition of dyes on easily melted models. The fundamental physical peculiarities of the separation flow are established. Independence of the length of the separation zone from the boundary layer thickness is proved. Local supersonic flows in the separation domain are detected; flow modes depending on the angle of contact of the stream with the obstacles are clarified. Characteristic flow zones are isolated in the interaction domain. Author

N69-31470# Commissariat a l'Energie Atomique, Paris (France).
EXPERIMENTAL STUDY OF THE WAVE-PARTICLE INTERACTION IN A PLASMA PRESENTING A DOUBLE-HUMP DISTRIBUTION FUNCTION [ETUDE EXPERIMENTALE DE L'INTERACTION ONDES-PARTICULES DANS UN PLASMA PRESENTANT UNE FONCTION DE DISTRIBUTION A DOUBLE BOSSE]
R. Frank 3 Nov. 1968 15 p refs In FRENCH Presented at Intern. Symp. on One Particle Distribution Functions in Plasmas, Marburg, Germany, 25 Aug. 1968
(CEA-CONF-1064; CONF-680830-2) Avail: AEC Depository Libraries

A detailed experimental study was made of the mechanism of energy exchange between the plasma oscillations and the electrons in a plasma having a double-hump distribution function. The experimental installation is briefly described and then the results are reported. These show that, in the relaxation regime, a plasma characterized by a distribution function verifying the conditions required by the application of the quasilinear theory was obtained. Deformation of the distribution function and growth of the waves were studied in detail in order to establish the energy exchange mechanism between the waves and the particles. Comparison between this mechanism and that deduced from the quasi-linear theory leads to the conclusion that the model described by this theory is valid. Author (NSA)

N69-31471# National Engineering Lab., Glasgow (Scotland).
DESIGNING FOR TWO-PHASE FLOW. PART 1: OPENING ADDRESS AND GENERAL
Jan. 1969 12 p refs Meeting held at Natl. Eng. Lab., 17 Jan. 1968
(NEL-386-Pt-1; CONF-680118-1) Avail: AEC Depository Libraries

The opening address of the meeting on two-phase flow in the vertical tubes of boilers, evaporators, heat exchangers, and similar equipment is presented. NSA

N69-31472# National Engineering Lab., Glasgow (Scotland).
DESIGNING FOR TWO-PHASE FLOW. PART 2: VOID FRACTION PREDICTION UNDER SATURATED CONDITIONS
Jan. 1969 49 p refs Meeting held at Natl. Eng. Lab., 17 Jan. 1968
(NEL-386-Pt-2; CONF-680118-3) Avail: AEC Depository Libraries

A review is given of some of the methods of measuring void fraction, together with some deduced correlations. A simple expression is given, based on a relative velocity model, for the prediction of void fraction over a fairly wide range of natural circulation conditions; this expression takes the form $x_s = cx_v$ where c is dependent on no-slip flow conditions. The proposed correlation is compared with the results of other workers, and close agreement obtained. Author (NSA)

N69-31473# National Engineering Lab., Glasgow (Scotland).
DESIGNING FOR TWO-PHASE FLOW. PART 3: PREDICTION OF FRICTION PRESSURE GRADIENTS
Jan. 1969 35 p refs Meeting held at Natl. Eng. Lab., 17 Jan. 1968
(NEL-387-Pt-3; CONF-680118-5) Avail: AEC Depository Libraries

Methods of calculating frictional two-phase pressure gradients are discussed and numerical examples given. Author (NSA)

N69-31474# National Engineering Lab., Glasgow (Scotland).
DESIGNING FOR TWO-PHASE FLOW. PART 4: PREDICTION OF PRESSURE LOSSES AT CHANGES OF SECTION, BENDS AND THROTTLING DEVICES
Jan. 1969 24 p refs Meeting held at Natl. Eng. Lab., 17 Jan. 1968
(NEL-388-Pt-4; CONF-680118-2) Avail: AEC Depository Libraries

Relationships are developed for the flow of two-phase mixtures through changes of flow cross sections, including recommendations for predicting pressure losses in these situations and through valves and pipe bends. Author (NSA)

N69-31475# National Engineering Lab., Glasgow (Scotland).
DESIGNING FOR TWO-PHASE FLOW. PART 5: HEAT TRANSFER DURING TWO-PHASE FLOW
Jan. 1969 30 p refs Meeting held at Natl. Eng. Lab., 17 Jan. 1968
(NEL-389-Pt-5; CONF-680118-4) Avail: AEC Depository Libraries

Correlations and procedures for calculating two-phase heat transfer in evaporating systems are reviewed. Author (NSA)

N69-31548# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.
THE MOTION OF AN OBSTACLE ALONG THE AXIS OF AN INFINITE ROTATING FLUID: AN EXACT INVISCID SOLUTION
Martha E. Smithmeyer and Yih-Ho Pao Nov. 1969 26 p refs
(AD-686323; DI-82-0789) Avail: CFSTI CSCL 20/4

In the rotating fluid of infinite extent, the motion of an obstacle along the axis always produces waves. The report details the behavior of these waves by satisfying boundary conditions on a dipole-type obstacle, which is nominally spherical in shape, so that this analysis somewhat parallels Lais extension to Longs work, although the techniques are different. The solutions are exact (for inviscid, incompressible flow) for each body shape; no assumptions of small amplitude disturbances and wave motion are made. Author (TAB)

N69-31568# Atomic Energy of Canada, LTD., Pinawa (Manitoba). Whiteshell Nuclear Research Establishment.
COLLAPSE MECHANISM OF FLUIDIZED BEDS SUBJECTED TO SUDDEN LOSS OF LIQUID FLOW
R. K. Armstrong, R. Mac Farlane, and A. C. Trupp Jun. 1968 41 p refs
(AECL-3028) Avail: CFSTI: CAN $1.00

Experiments were conducted to determine the collapse behavior of a fluidized bed of spheres subjected to sudden loss of flow of the supporting liquid. Observations showed the particles fell en masse and the mobile phase maintained the starting porosity. Following an initial short acceleration period, the particles fell at a constant limiting velocity (V_f) with respect to the tube which was found to be a function of the single sphere terminal velocity (V_T) and the initial porosity (ϵ). Experimental techniques for determining V_f are described and the data presented. Under conditions of Newton flow and negligible wall effects, the collapse velocity, V_f, was given by: $V_f = 0.826(V_T)^{1.18}(\epsilon)^{2.28}$, V_f and V_T = m/s. Particle mechanics theory is used to demonstrate the mobile phase is actually fluidized during the collapse. The application of the results to the design (hazards analysis) of a liquid fluidized bed nuclear reactor is discussed briefly. Author (NSA)

N69-31571# Sandia Corp., Albuquerque, N.Mex.
AUTOROTATION CHARACTERISTICS OF VARIOUS SHAPES IN SUBSONIC AND HYPERSONIC FLOWS
A. C. Bustamante and G. W. Stone Apr. 1969 43 p refs
(SC-RR-69-159) Avail: CFSTI

An experimental and analytical study which was conducted to investigate the dynamic characteristics of autorotating configurations in subsonic and hypersonic flows is described. For these studies, a new technique was developed for calculating dynamic stability derivatives. Author (NSA)

N69-31572# Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Applied Mathematics.
NUMERICAL INTEGRATION OF EQUATIONS OF MOTION OF A VISCOUS FLUID Final Scientific Report, 1 Sep. 1967–31 Aug. 1968
Joseph Gillis and Nadav Liron Aug. 1968 98 p refs
(Contract F61052-68-C-0053)
(AD-686099; AFOSR-69-0979TR) Avail: CFSTI CSCL 20/4

Two problems of time-dependent viscous flow are studied by direct numerical methods. The first is the development of flow in a semi-infinite straight channel, closed at one end by a piston, when the piston is set in motion with a finite acceleration. The second problem is that of development of flow in a cylinder filled with liquid when the cylinder is set in motion by an impulsive rotation about its axis. Both flows are studied in detail, with particular reference to development and the factors which govern it. In both problems some special cases can be isolated and treated by alternative methods. This provides a check on the accuracy of the numerical solutions. Author (TAB)

N69-31702# Harry Diamond Labs., Washington, D.C.
FLUERIC SENSOR FOR RF-INDUCED CURRENTS IN BRIDGE WIRES
J. Kent Haspert Mar. 1969 19 p refs
(AD-686278; HDL-TM-69-5) Avail: CFSTI CSCL 13/7

A simple system that employs the nonlinear fluid resistance of an orifice to detect the heat generated by small currents in bridge wires has been tested. The system utilizes the dependence of the orifice flow resistance on temperature to indicate the current through a bridge wire and produces an analog pressure readout. The system has a threshold of about 15 mA (for an 8.5-ohm bridge wire) and a thermal time constant of 3.5 sec. Suggestions are given for possible ways of improving both sensitivity and response time. Author (TAB)

N69-31743# California Univ., Los Angeles. Dept. of Physics.
ULTRASONIC ATTENUATION IN LIQUID HELIUM AT 1 GHz
James Susumu Imai Apr. 1969 62 p refs
(Contract Nonr-233(48))
(AD-686079; TR-28) Avail: CFSTI CSCL 20/13

The ultrasonic attenuation in liquid helium at 1 GHz was measured from about 1.1 to 4.2K by a method which gives a direct measurement of the absolute attenuation. The results are described in terms of three regions: a classical normal fluid region above 2.3K, a critical region near the lambda transition, and a superfluid region below 2.0K. In the normal fluid region, the attenuation is due to classical shear viscosity and thermal conductivity, and is described by the Stokes-Kirchhoff equation. The results give good agreement when compared with the theoretical Stokes-Kirchhoff attenuation curve. In the critical region, the results are shown to differ in a fundamental way from those found at lower frequencies. The Landau-Khalatnikov order parameter relaxation mechanism is shown to contribute insignificantly to the attenuation in this region. The measurements show a very large non-singular peak of about 2000 cm(-1) centered at or very nearly at the lambda transition. In the superfluid region, the attenuation measurements show the local maximum at 1.5K which separates the hydrodynamic from the collisionless regime. The results are shown to be in agreement with the elementary excitation relaxation theory of Khalatnikov and Chernikova. Author (TAB)

N69-31748*# National Aeronautics and Space Administration, Washington, D.C.
CALCULATIONS OF THE EQUATIONS OF A THREE-DIMENSIONAL LAMINAR BOUNDARY LAYER BY THE INTEGRAL METHOD
V. A. Bashkin Jul. 1969 12 p refs Transl. into ENGLISH from Zh. Vychislitel'noi Mat. i Mat. Fiz. (Moscow), v. 8, no. 6, 1968 p 1280–1290
(NASA-TT-F-12293) Avail: CFSTI CSCL 20D

The method of integral relationships is applied to a numerical integration of the equations of three dimensional laminar boundary layer when there is a conical external flow. An estimation is made of the accuracy of the calculation of local heat flux, local friction, profiles of frictional stress, rate of secondary flow, and the total enthalpy. Author

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N69-30445# Aerospace Corp., El Segundo, Calif. Lab. Operations.
SPACE PHYSICS LABORATORYS SUMMARY OF SPACE RESEARCH SUBMITTED TO COSPAR, CY 1968
George A. Paulikas 20 Jan. 1969 19 p refs
(Contract F04701-68-C-0200)
(AD-685159; TR-0200(4260-01)-1; SAMSO-TR-69-51) Avail: CFSTI CSCL 04/1

Results are presented from experiments on USAF/OAR satellites 1966-70A, 1968-28B, and 1968-59A. The outstanding accomplishments of 1968 were the measurements of atmospheric density and composition at low altitudes (150 to 500 km) with experiments on 1968-59A. Author (TAB)

N69-30618*# Nevada Univ., Reno. Mackay School of Mines.
GROUND DATA INVESTIGATIONS MT. LASSEN, SITE-56-MISSION 76
Jack G. Ousde, Peter E. Chapman, and Peter A. Brennan Sep. 1968 30 p *Its* Tech. Letter No. 13
(Contract NAS9-7778)
(NASA-CR-101765) Avail: CFSTI CSCL 08F

The prime instrument for the mission is the MR62–MR84 microwave radiometer system. The Reconofax LV and both ektachrome I.R. (color I.R.) and Plus X (black and white) photography was flown as supplementary instruments to the radiometers. The radar scatterometer was also flown as a secondary instrument. Microwave radiometry was obtained for look angles of 10°, 30°, and 45° for both vertical and horizontal polarizations day and night. Four ground stations were manned during both flights to provide ground truth data. Author

N69-30621*# Nevada Univ., Reno. Mackay School of Mines.
COMPUTER CONTROLLED X-RAY SPECTROMETRIC ANALYSIS OF GEOLOGICAL MATERIALS
Paul A. Weyler Mar. 1968 21 p refs *Its* Tech. Letter No. 11
(Grant NGR-1-38-7751)
(NASA-CR-101750) Avail: CFSTI CSCL 08F

The use of an SRS-1 spectrometer interfaced to a PDP-8 computer is reported for the quantitative, elemental analyses of geological samples collected for NASA's Remote Sensing Project. Descriptions are given of the various operating parameters controlled by the computer including the sequence field, the count-limit and repetition-limit options, method of calculation, and general mode of operation. Author

N69-30636# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
BASE EXTENSION NET MEPPEN 1960 TELLUROMETRIC MEASUREMENTS OF THE INSTITUTE FOR APPLIED GEODESY (SECTION 2 OF THE GERMAN GEODETIC RESEARCH INSTITUTE) [BASISVERGROESSERUNGSNETZ MEPPEN 1960 DIE TELLUROMETERMESSUNGEN DES INSTITUTS FUER ANGEWANDTE GEODAESIE (ABT. II DES DEUTSCHEN GEODAETISCHEN FORSCHUNGSINSTITUTS)]
Hans Meichers 1968 28 p refs In GERMAN; ENGLISH summary *Its* Pamphlet No. 124-III)
(Rept-96) Avail: CFSTI

Attention is mainly paid to the conditions which have an influence on tellurometer measurements, such as meteorology, relief, pedology, and vegetation. The factors are represented by a graph which is easy to read and invites comparison with other measurements. By forming a progressing and overlapping mean value, with an adjusting straight line as limiting value, a tool is offered for describing the ground swing from a minimum of information. When judging the relief it seems that such notions as profile in form of slight concave curvature, diaphragms to sight, and very wet soil have a certain importance, although the terrain dealt with is very flat. In any case it is impossible to draw definite conclusions. Author

N69-30637# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
BASE EXTENSION NET GOETTINGEN 1961: CALCULATION OF THE ANGULAR WEIGHTS [BASISVERGROSSERUNGSNETZ GOETTINGEN 1961 DIE BERECHNUNG DER WINKELGEWICHTE]
Hans-Joachim Spiess and Helmut Wolf 1967 23 p refs In GERMAN; ENGLISH summary *Its* Pamphlet No. 100-I
(Rept-95) Avail: CFSTI

Referring to the procedure described in detail for the base extension net of Meppen 1960 and used to determine the weights of angles and the number of repetitions for each round of horizontal angles, this paper presents a modification of this method as applied to the base extension net of Göttingen in 1961, in order to take into account the systematic components of observation errors. A special peculiarity of the net, the simultaneous transfer of the length of the base line to three main triangulation sides, necessitates an extension of the process of calculation. As result of the calculations the final plan of observations is published. The responsibility of the observer to modify the calculated plan of observations, if special local conditions require it, is pointed out. See also abstract N69-30636. Author

N69-30646# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
TELLUROMETRIC MEASUREMENTS OF THE INSTITUTE FOR APPLIED GEODESY IN 4 QUADRANGLES IN THE LOWER-SAXONY AREA OF THE GERMAN PRIMARY TRIANGULATION NET [TELLUROMETERMESSUNGEN DES INSTITUTES FUER ANGEWANDTE GEODAESIE IN 4 VIERECKEN IM NIEDERSAECHSISCHEN RAUM DES DEUTSCHEN HAUPTDREIECKSNETZES]
Hermann Dirk and Dieter Ehlert 1967 58 p refs In GERMAN; ENGLISH summary *Its* Pamphlet No. 135
(Rept-88) Avail: CFSTI

The data were obtained in three open quadrilaterals and one braced quadrilateral of the primary triangulation net in the region of Lower Saxony during the period 1963–1966. The results of the observations and the adjustments in the trilateration networks are presented in this paper. Transl. by K.W.

N69-30647# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
BASE EXTENSION NET GOETTINGEN 1961: ANGULAR OBSERVATIONS AND NET ADJUSTMENT [BASISUERGROESSERUNGSNETZ GOETTING 1961 WINKELBEOBACHTUNGEN UND NETZAUSGLEICHUNG]
Hans-Joachim Spiess 1968 57 p refs In GERMAN; ENGLISH summary *Its* Pamphlet No. 100-II
(Rept-97) Avail: CFSTI

The first-order angular field observations and appropriate evaluation work executed in 1961 in the base extension net near Göttingen are described. The calculations pertaining to the angular net adjustment with condition observations and with two different weights, as well as those performed to determine the errors of transfer for angles and sides are explained. The results of angular adjustment, of the computations of sides, and of the errors of transfer are compiled. Author

N69-30648# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
GRAVIMETRIC DEVIATIONS FROM THE VERTICAL AT THE STATIONS SINDLINGEN, MAINFLINGEN AND HOMBURG [GRAVIMETRISCHE LOTABWEICHUNGEN AUF DEN STATIONEN SINDLINGEN, MAINFLINGEN UND HOMBURG]
Franz Hilger 1968 55 p refs In GERMAN; ENGLISH summary *Its* Pamphlet No. 161
(Rept-107) Avail: CFSTI

The deflections of the vertical were calculated by means of free air free anomalies. The accuracy of the calculated values has been estimated. The formulas of *Vening Meinesz* have been integrated by means of circular ring templates over the whole of the earth's surface. The gravimetric deflections of the vertical are compared with the corresponding astro-geodetic deflections of the vertical. Author

N69-30650# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE TRANSFORMATION OF PHOTOGRAMMETRICALLY DETERMINED COORDINATES [DIE UMFORMUNG PHOTOGRAMMETRISCH GEMESSENER KOORDINATEN]
Rudolf Forstner 1967 89 p refs In GERMAN; ENGLISH summary *Its* Pamphlet No. 130
(Rept-86) Avail: CFSTI

When coordinates are measured photogrammetrically the machine coordinates have to be transformed into the national survey system. This paper deals with the differences of some transformation formulas and their influence on points to be transformed, illustrating them by means of schematic examples. The coordinates of 33 stereograms pertaining to a project of land consolidation have been transformed by seven different procedures, and in each case the usual units of error have been computed. The results are critically compared. The relations between measuring errors, errors of control points, and the so-called pseudo systematic errors, i.e. the individual errors of a stereogram, are important for judging the quality of a transformation method. The advantages and disadvantages of the different transformation methods are described with regard to the fitting and junction errors to be considered. Author

N69-30651# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
LOW TEMPERATURE SCIENCE. SERIES A: PHYSICAL SCIENCES, NO. 26
1968 423 p refs In JAPANESE; ENGLISH summaries
Avail: CFSTI

Low temperature data are presented, with particular emphasis on the optimum snow and ice conditions for the 1972 Olympic Winter Games to be held in Sapporo, Japan. For individual titles, see N69-30652 through N69-30672.

N69-30653# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
LIQUID PERMEABILITY OF SNOW
Daisuke Kuroiwa *In its* Low Temp. Sci. Ser. A: Phys. Sci., No. 26 1968 p 29–52 refs In JAPANESE; ENGLISH summary (See N69-30651 17-13)
Avail: CFSTI

Three types of kerosene permeameters were designed to measure the liquid permeability of snow without disturbing the original snow stratification. The principle of these kerosene permeameters is analogous to the ordinary falling head method used in soil physics. A reproducible value of kerosene permeability of snow can be obtained even when many tests were repeated on the same specimen of snow, because the solubility of ice in kerosene is negligibly small below the melting point of ice. A number of measurements were made for various types and densities of snow and all data were reduced to the values of permeability at a given temperature (−5°C), taking into account the temperature dependence of the kerosene viscosity. The value of kerosene permeability of snow ranged between $10^{-1} \approx 8 \times 10^{-1}$ cm/sec for fine grained snow, and $8 \times 10^{-1} \approx 4$ cm/sec for coarse grained snow. No definite correlation was found between the permeability and porosity of the natural snow, but the value of kerosene permeability of artificially compressed snow was decreased exponentially with decreasing porosity. Author

N69-30654# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
INFILTRATION OF MELT WATER INTO SNOW COVER. PART 2
Gorow Wakahama, Tsutomu Nakamura, and Yasuichi Endo *In its* Low Temp. Sci. Ser. A: Phys. Sci., No. 26 1968 p 53–76 refs In JAPANESE; ENGLISH summary (See N69-30651 17-13)
Avail: CFSTI

The combination calorimeter, designed by Z. Yosida, was used to measure free water content in each of the snow layers composing the snow cover. General stratigraphy, density, temperature, Kinosita's hardness, tensile strength, and grain size of the snow were also measured. Air temperature, wind speed, solar radiation and net long wave radiation were also observed. So-called strong water-holding boundaries were found at the level of 165 cm. These boundaries were not caused by an ice sheet, but by a change in the texture of the snow. The thickness of the uppermost layer of snow, which maintained a large value for free water content, remained constant at three centimeters despite the absence of ice sheets or strong water-holding boundaries at that depth. The grain size in water channels was much larger than that in the general snow layers, suggesting that the melt water caused the ice grains to grow quickly, thus changing the texture of the snow from fine to coarse grain. In water channels, dry density and free water content were larger, and hardness was smaller, than those in the general snow layers. M.W.H.

N69-30655# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
INFILTRATION OF MELT WATER INTO SNOW COVER. PART 3: FLOWING DOWN SPEED OF MELT WATER IN A SNOW COVER
Gorow Wakahama *In its* Low Temp. Sci. Ser. A: Phys. Sci., No. 26 1968 p 77–86 refs In JAPANESE; ENGLISH summary (See N69-30651 17-13)
Avail: CFSTI

The speed v of melt water flowing down in water channels was measured directly on various types of snow. The observed values (v≈1.2 to 1.5 cm/sec) agree with the calculated values rather well for fine grain snow, but not as well for coarse grain snow. The mean speed of melt water flowing down in the form of water films was experimentally measured by two methods. The first employed a small amount of eosine dye, dusted on the surface of a melting snow cover. The dye dissolved instantly into the melt water at the surface and the colored melt water permeated the snow cover; its paths were traced through the snow. The second method measured the mass flux Q of the melt water flowing down, and used this value along with the wet density and free water content of the water films to obtain values for the mean speed. In this case, good agreement was obtained between observed and calculated values in coarse grain snow, while the values for fine grain snow showed poor agreement. M.W.H.

N69-30656# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
MEASUREMENT OF FLOW DOWN SPEED OF MELT WATER IN SNOW COVER
Kazuo Fujino *In its* Low Temp. Sci. Ser. A: Phys. Sci., No. 26 1968 p 87–100 refs In JAPANESE; ENGLISH summary (See N69-30651 17-13)
Avail: CFSTI

Measurements were made in the following manner using an electrolyte (NaCl) solution as a tracer. First, the electrolyte is spread on the melting surface of the snow cover. The melt water on the surface dissolves the electrolyte and produces a water mass which has a fairly low resistivity compared with ordinary melt water, and then the water mass flows down into the snow cover. Several pairs of electrodes were arranged in the snow cover at each 5 cm of depth. By observing the variation of electrical resistance of each electrode which is caused by the change of the electrolyte concentration in the snow texture around the electrodes, the mean

flow down speed of melt water in the snow cover can be obtained. Under such considerations, the values of $2-5115^{-3}$ cm/sec as the mean flow down speed of melt water in a snow cover when free water content is about 10–15% were obtained. The flow down speed of melt water in a snow cover depends on the free water content held therein. When the free water content is relatively small, the melt water flows down around the snow texture forming a thin water film of 30–40 microns thick. Such considerations render the obtained values of flow down speed to be reasonable in this case. Author

N69-30667# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.

A FIELD EXPERIMENT ON SNOW MELT CONTROL

Renji Naruse *In its* Low Temp. Sci. Ser. A: Phys. Sci., No. 26 1968 p 101–103 refs In JAPANESE; ENGLISH summary (See N69-30651 17-13)

Avail: CFSTI

When a small area of the snow surface is covered with some materials, the so-called dirt cones are sometimes formed as a result of protection against snow melt. On the glacier, these materials are generally fine rock flour. As a part of a synthetic observations of snow melt, a field experiment on the formation of dirt cones was made in Hokkaido, April, 1968. Three kinds of dirt materials, sand, sawdust and coal-ash, were carefully laid on a square area of the melting snow surface. The thickness of each material was about 2, 1 and 2 cm respectively and the side of square was 50 or 100 cm in length. During 10 days, the melting progess of these squares was observed and photographed. After one week, the level of the sawdust was observed to be higher than the general level of the surrounding snow surface, but that of the sand to be much lower and that of the coal-ash to be slightly higher. From this work, it is found that the sand accelerates snow melt considerably; on the other hand the sawdust controls it. Author

N69-30668# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.

SNOWMELT-RUNOFF AT MOSHIRI

Daiji Kobayashi, Renji Naruse, and Hirobumi Oura *In its* Low Temp. Sci. Ser. A: Phys. Sci., No. 26 1968 p 105–111 In JAPANESE; ENGLISH summary (See N69-30651 17-13)

Avail: CFSTI

The total amount of runoff during 11 days was 2.54×10 cm in water (the first method) 2.46×10 cm in water (the second method) and that of the snowmelt was 2.44×10 cm in water in the same period. Generally speaking, the runoff of meltwater is affected by a considerable number of factors, such as the solar and other radiations, heat conduction from the air, the characteristics of the snow cover, the size and the topography of the basin, vegetation and the type of soil. Good coincidence was shown between daily snowmelt and its runoff. The base runoff is not certain but should be lower than 0.14 cm/day. These results justify the method of estimation of snowmelt in a drainage area from the observation of stream flow, and frees the worker from the difficult and troublesome direct measurement of snowmelt over a wide area. The time of draining down of melt water through the snow cover to the ground will be calculated by an application of the nonlinear unit-hydrograph theory. Author

N69-30669# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.

REPORT OF SNOW COVER OBSERVATIONS, SAPPORO, 1965–1967

Kenji Kojima, Daiji Kobayashi, Shunichi Kobayashi, Gorow Wakahama, Tsutomu Nakamura et al *In its* Low Temp. Sci. Ser. A: Phys. Sci., No. 26 1968 p 113–142 refs In JAPANESE; ENGLISH summary (See N69-30651 17-13)

Avail: CFSTI

Observations were made routinely on the 5th, 15th, and the 25th of each month at the Institute tennis court which has a fairly flat and level surface. The methods of observation were almost the same as those described in the first report of snow cover observations in Sapporo, 1963–64 by Kojima et al. (1965). For the measurements of hardness of snow the Canadian hardness gage was used in 1966–67 in addition to Kinosita's method which is generally used in Sapporo. The vertical profiles of snow density G in $g\cdot cm^{-3}$, hardness H in $kg\cdot cm^{-2}$, snow temperature T_s in °C, and free water content W in % are graphically shown for 1965–66 and 1966–67. Daily maximum and minimum air temperatures in Sapporo and variation of the depth of snow cover with time during the two winter periods are shown. Curves showing densification of each snow layer are based on the results of pit wall observations. The accumulation and the properties of snow in the winter of 1966–67 are quite typical of those observed in Sapporo. The variation of the density, hardness, temperature, and the thickness in cm of some selected snow layers is shown with time in days since their deposition. Author

N69-30680# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.

STUDY ON INTERNAL STRAIN OF SNOW COVER ON SLOPE 1

Hiromu Shimizu *In its* Low Temp. Sci. Ser. A: Phys. Sci., No. 26 1968 p 143–168 refs In JAPANESE; ENGLISH summary (See N69-30651 17-13)

Avail: CFSTI

The internal strain of the snow cover was measured at regular intervals throughout the snow season by means of small holes bored in the snow cover parallel to the contour line of the slope, the grand line of the observation. At the start of the season, holes were arranged along a vertical straight line, and on a circle. Displacement of individual holes, and deformation of the linear and circular configurations were measured approximately every two weeks on a vertical wall of the snow cover which was parallel to the maximum slope line. Internal strain of the snow cover was found to be uniform in each component layer of the cover, but nonuniform for the whole cover. The strain was also found to be occasionally nonuniform in component layers during active snow melt seasons. The strain rates appeared to be predominantly affected by the mechanical strength of the snow. It was also noted that the strain rates of snow on the south slopes varied throughout the snow season, but that those of the north slopes remained fairly steady until the snow melt season. M.W.H.

N69-30681# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.

PROPERTIES OF SNOW COVER AT AVALANCHE RESEARCH STATION, TOIKANBETSU, NORTHERN HOKKAIDO

Tosio Huzioka, Hiromu Shimizu, Eizi Akitaya, and Hideki Narita *In its* Low Temp. Sci. Ser. A: Phys. Sci., No. 26 1968 p 169–185 refs In JAPANESE; ENGLISH summary (See N69-30651 17-13)

Avail: CFSTI

For several years, the properties of snow cover and their changes under natural conditions have been investigated at Toikanbetsu where the Avalanche Research Station of the Institute of Low Temperature Science was established in 1965. In the winter of 1967–68, the snow depth was recorded continuously by a snow camera which was devised to take recording pictures of a snow pole automatically twice a day. The properties of snow were examined every two weeks at four research sites. Two sites were on the south slope and two were on the north slope of the same ridge. Fragile layers of depth hoar were found near the ground every winter at all sites. The density and hardness of this snow were smaller than those of snow in the upper and lower layers. The snow

from which the depth hoar was derived accumulated at the beginning of winter and thereafter melted and refroze. The date of the occurrence of ground avalanches on the south slope for the past three winters shows that that the snow cover withstood avalanching for a considerable length of time when the density of the fragile layer was large. Author

N69-30662# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.

SNOW COVER OBSERVATIONS AT THE AVALANCHE RESEARCH STATION, TOIKANBETSU, NORTHERN HOKKAIDO, PART 2, 1965–1968

Tosio Huzioka, Hiromu Shimizu, Eiti Akitaya, and Hideki Narita *In its* Low Temp. Sci. Ser. A: Phys. Sci., No. 26 1968 p 187–214 refs In JAPANESE; ENGLISH summary (See N69-30651 17-13)
Avail: CFSTI

An investigation was carried out to obtain information on snow accumulation, physical properties of the snow cover and their changes during winter in avalanche hazard areas since the winter of 1963–64. Observations during the three winter seasons of 1965–66, 66–67 and 67–68 were made at four sites; two of them were located on the south slope of Nakanomine ridge and the other two were located on the north slope of the same ridge. Author

N69-30663# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.

STUDIES OF FERN ON MT. DAISETSU IN SUMMER, PART 3

Gorow Wakahama, Yasoichi Endo, Tomomi Yamada, Hisao Ushiki, and Renji Naruse *In its* Low Temp. Sci. Ser. A: Phys. Sci. No. 26 1968 p 215–229 refs In JAPANESE; ENGLISH summary (See N69-30651 17-13)
Avail: CFSTI

Small firn fields are formed in some valleys in the Daisetsu mountain range stretching across the central part of Hokkaido. They remain unmelted during the summer and may be called glacierets. Glaciological studies have been made over the past several years on one of the glacierets named Yukikabe, which is located near the top of a valley carved on the eastern side of a plateau called Takanega-hara (1,730 m above sea level). During the ablation season of 1966, the research for the third year was carried out five times at intervals of about one month. The main objective was to observe the metamorphism of snow texture and the process of ablation of the entire glacieret. The metamorphism of snow into a firn proceeded rather quickly, because the snow retained melt water throughout its entire mass during the summer. Author

N69-30664# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.

STUDIES ON SNOW AND ICE FOR THE OLYMPIC WINTER GAMES, 1972

Zyungo Yosida *In its* Low Temp. Sci. Ser. A: Phys. Sci., No. 26 1968 p 231–247 In JAPANESE; ENGLISH summary (See N69-30651 17-13)
Avail: CFSTI

Snow was investigated at various places, and whether conditions were favorable or not for the games was adjudged by the skiers who participated in the trial runs. According to their opinion, the best snow was wind packed slab found on one of the ridges at Mt. Asahidake (2290 m above sea level). This was 50 cm in thickness and extended over an area 20 x 100 m. It was evenly packed from top to bottom with a considerable hardness, adhering firmly to the frozen ground. The average density was 0.53 g/cm^3, and the average hardness was found to be 8 kg/cm^2. The next best location was found on paths leading to a skiing ground. In such places, the snow is packed down by the constant passage of skiers from the beginning of the skiing season. The ground was frozen and the connection between the snow and the ground was strong. The temperature of ice was measured during actual skating matches. The surface temperatures in a range of $-2°$ to $-3°$C were found to be the best for speed skating; the participants obtained the best records at these temperatures and stated that the ice was in a favorable condition. Author

N69-30665# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.

PRELIMINARY INVESTIGATIONS ON SKI AND LUGE COURSES FOR THE 11th OLYMPIC WINTER GAMES TO BE HELD AT SAPPORO IN 1972

Daisuke Kuroiwa et al *In its* Low Temp. Sci. Ser. A: Phys. Sci., No. 26 1968 p 249–267 refs In JAPANESE; ENGLISH summary (See N69-30651 17-13)
Avail: CFSTI

The preliminary investigations of snow were carried out at the Shimofujino luge course, Kitanomine and Mt. Daisetsu ski areas. The following conclusions were drawn: when a luge course is constructed of snow instead of ice, the snow should be strengthened by compression and spraying of cold water in such a way that the values of apparent density and hardness of the compressed snow exceed 0.5 g/cm^3 and 10 kg/cm^2, respectively. Similar reinforcements of ski courses are necessary for giant slalom or down hill games, but it may not be necessary to maintain the thickness of snow in excess of 30–40 cm. Author

N69-30666# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.

SNOW COVER OBSERVATIONS AT MT. ENIWA

Tosio Huzioka, Hiromu Shimizu, Eiti Akitaya, Hideki Narita, and Seiiti Kinosita *In its* Low Temp. Sci. Ser. A: Phys. Sci., No. 26 1968 p 269–275 refs In JAPANESE; ENGLISH summary (See N69-30651 17-13)
Avail: CFSTI

An investigation on the physical properties of snow cover was carried out on the slope of Mt. Eniwa where the down hill ski game of the 11th Olympic Winter Games is to be held in 1972. The snow cover observations were made on 22nd and 23rd, February, 1968, at three sites: the start, the finish, and the intermediate point. At each site the snow structure of the lower half of the snow cover was the depth hoar crystals which made the snow cover very fragile. At the start, the hardness of snow was less than 0.1 kg/cm^2 on the scale of Kinosita's hardness gage. It was estimated from the size of the depth hoar crystals that they began to grow at the middle of January. The snow of the ski game track must be sufficiently hard to withstand scraping away by the steel edges of the ski. The investigation of snow made at Mt. Daisetsu showed that the snow with the hardness more than 7 kg/cm^2 is suitable for a track of the ski game. The snow on the track must be stamped down by foot or by machine to make the snow hard at the beginning of January and the stamping must be continued by the day of opening of the game which is scheduled to be on 4th of February. Author

N69-30667# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.

HARDENING OF SNOW BY TRAMPLING AND ACCUMULATION OF INDUCED SNOW DRIFTS BY FENCES SET UP ALONG THE SLALOM COURSE AT MT. TSUNE

Hirobumi Oura, Daiji Kobayashi, Shunichi Kobayashi *In its* Low Temp. Sci. Ser. A: Phys. Sci., No. 26 1968 p 277–298 In JAPANESE; ENGLISH summary (See N69-30651 17-13)
Avail: CFSTI

The snow is soft on Mt. Teine and it is not suitable for slalom games. It is desirable to harden it artificially. The snow in a test area of 1×1 m or 1.2×1.2 m was hardened by trampling. Three test areas were used in one test. The first area was compacted by merely trampling on it. The second area was trampled after sprinkling with 10 l/m^2 of water, and the third area was trampled on after 1.2 kg/m^2 of salt was spread over the area. The same area was trampled 20 times by a man weighing 60 kg. One test, for example, showed that the hardness of natural snow before trampling was not more than 1 kg/cm^2, but it became harder after two weeks. The hardness was 35 kg/cm^2 for the first area, 45 kg/cm^2 for the second area, and 21 kg/cm^2 for the third area. The conclusions obtained are as follows: the more the snow is trampled on, the harder it becomes; the area sprinkled with water became harder than the nontreated area; the area sprinkled with salt not only failed to become harder but became somewhat softer than the nontreated area; and the hardness increases with the amount of trampling. Author

N69-30668# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.

STUDIES ON THE PROERTIES OF ICE IN SKATING RINKS

Teisaku Kobayashi and Takemichi Kitahara *In its* Low Temp. Sci. Ser. A: Phys. Sci., No. 26 1968 p 297–314 refs In JAPANESE; ENGLISH summary (See N69-30651 17-13)
Avail: CFSTI

Preliminary investigations for the 11th Olympic Winter Games were made at Obihiro and Karuizawa skating rinks to determine the optimum conditions of ice for skating. Various methods were tested to measure the surface temperature of rink ice, and the most reasonable results were obtained by the use of a thermister thermometer and an ordinary thermometer placed on the ice surface and covered partly with a thin ice slab. In this case, a small shade covering the entire length of thermometer was used to shade the thermometer. The surface temperature and Brinell hardness of ice were measured and discussed in relation to personal impressions of skaters on the ice condition and time records of the highly skilled athletes. The optimum condition of the surface temperature for skating was found to be $-2 \simeq -3°C$ at 36th All Japan Speed Skating Championship at Karuizawa. Author

N69-30669# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.

CHARACTER OF THE WIND-SPEED PROFILE DURING DRIFTING SNOW, PART 2

Hirobumi Oura, Shunichi Kobayashi, and Daiji Kobayashi *In its* Low Temp. Sci. Ser. A: Phys. Sci., No. 26 1968 p 315–328 refs In JAPANESE; ENGLISH summary (See N69-30651 17-13)
Avail: CFSTI

During drifting snow, the wind speed profile is expected to be expressed by the following equation, as set forth by Bagnold for sand storms: $U_z = 5.75U_* \log z/z_1 + U_1$. Where U_z is the wind speed at the height z, and the values U_1 and z_1 show no change even when the drag velocity U_* changes with time. It is said that the value U_1 is equal to the threshold velocity at which time the drifting of snow commences and the value z_1 is equal to the height of saltation of snow particles. The values of U_1 and z_1 during drifting snow are obtained from the same data used in the previous paper. With the change of conditions of drifting snow, the value of U_1 changed in a range of 1 to 4 m/s, and the value of z_1 changed in a range of 0.01 to 1.0 cm. Autocorrelation function $R(\tau)$ of the wind speed during drifting snow and that during no drifting snow were calculated using the record of the wind speed measured by an ultrasonic anemometer at 15–40 centimeters above the snow surface. The function $R(\tau)$ decreases more rapidly in the case of drifting snow than in the case of no drifting snow. From this fact, it is concluded that the smaller eddies are produced by the flying snow particles during drifting snow. Author

N69-30670# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.

THERMAL PROPERTIES OF SEA ICE. PART 4: THERMAL CONSTANTS OF SEA ICE

Nobuo Ono *In its* Low Temp. Sci. Ser. A: Phys. Sci., No. 26 1968 p 329–349 refs In JAPANESE; ENGLISH summary (See N69-30651 17-13)
Avail: CFSTI

A new sea ice model is proposed for calculating the thermal constants of sea ice. The sea ice model consists of pure ice, brine at an equilibrium concentration, and spherical air bubbles dispersed uniformly both in the pure ice and in the brine. These bubbly ice and bubbly brine models are arranged in parallel with the heat flow passing through the model of sea ice. Thermal constants of sea ice, namely density, thermal conductivity, specific heat, changes in heat content, heat of fusion, and thermal diffusivity are theoretically defined and are calculating using this model as a function of temperature, salinity, and air bubble content of sea ice. To induce the temperature of z to a minimum value on its vertical profile, containers of freezing mixture and of sea water were alternately placed on the surface of the sea ice cover in which a thermocouple chain was embedded. Author

N69-30671# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.

STUDY OF THE VARIATION OF OCEANOGRAPHIC CONDITION NORTHEAST OF HOKKAIDO IN THE SEA OF OKHOTSK, PART 1

Masaaki Aota *In its* Low Temp. Sci. Ser. A: Phys. Sci., No. 26 1968 p 351–361 refs In JAPANESE; ENGLISH summary (See N69-30651 17-13)
Avail: CFSTI

In warmer seasons, the Soya warm current runs southeastward along the Okhotsk coast of Hokkaido. It was found that this warm current was weakened in autumn, and finally disappeared, on the surface, on Nov. 15, 1967 and Nov. 26, 1966. In spring, after the passing of the sea ice season, the warm current appeared again in this region. Though the data of appearance is not certain, it was estimated as the end of April in 1966, and the middle of April in 1967. However, at the bottom of the sea (approximately 100 m in depth), a high saline water mass (chlorinity 18.6%) was observed 5 to 20 nautical miles off Mombetsu harbor in December and in April of the following year. This high saline water mass seems to suggest that the Sóya warm current may still exist in winter as an undercurrent. Author

N69-30672# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.

FROST HEAVE IN KITAMI

Seiiti Kinosita, Kaoru Horiguchi, Kunio Tanuma, and Taketoshi Ono *In its* Low Temp. Sci. Ser. A: Phys. Sci., No. 26 1968 p 363–381 refs In JAPANESE; ENGLISH summary (See N69-30651 17-13)
Avail: CFSTI

The heave amount of the surface of frozen ground, the temperature profile in the soil, frost penetration, and the heaving force, namely, the force which the ground exerts when its heave is suppressed completely, have been measured continuously at Kitami, Hokkaido, throughout each winter since the winter of 1961–1962. Several pipes (iron, vinyl, concrete; 100 cm in length, 7.6 cm in diameter) were previously buried vertically in the ground before winter. Because the soil freezes to the pipes, a tendency was seen to rise together with the ground as it heaved. The rise depends on the pipe weight. The total thickness of all ice lens appearing in the frozen soil was found to correspond very closely to the heave amount of the ground surface. It is suggested that approximately 25% of the soil was left unfrozen at freezing.

covering the soil particles (180 Å in thickness), and that the soil moisture migrating upwards from below passed through the liquid layer covering the soil particles, resulting in a segregation into ice lens. Author

N69-30681# Defence Research Board, Ottawa (Ontario).
HEAT FLUX THROUGH THE FLOOR OF THE ARCTIC BASIN IN THE REGION OF THE LOMONOSOV RIDGE
Ye. A. Liubimova et al May 1969 5 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSR (Moscow), no. 184, 1969 p 403–405
(T-518-R) Avail: CFSTI

The mid-oceanic ridge in the Arctic Basin is defined as a part of the ridge and rift system of this planet: it possesses magnetic and thermal anomalies and high seismicity. Heat flux measurements of the Arctic Basin were performed from a drifting ice field which presumably passed over Lomonosov Ridge toward the North Pole. The temperature sensors used were thermistors mounted on insulating outriggers on the metal body of the probe that embeds itself into the top layer of the ocean floor sediments. The flux values obtained are 40% higher than the global mean for the earth, indicating an enhanced energy output activity which is characteristic of block-type ridges. J.A.M.

N69-30685*# Nevada Univ., Reno. Mackay School of Mines.
GROUND TRUTH PARAMETERS FOR PADRE ISLAND, TEXAS
Joseph Lintz, Jr. Aug. 1967 16 p refs *Its* Tech. Letter No. 9
(Contract NAS9-7044)
(NASA-CR-101761) Avail: CFSTI CSCL 08F

Padre Island, Texas was chosen for the acceptability flight tests of an infrared spectrometer. Goals of the checkout flight were: (1) to verify the suspected high silica content of the sands, (2) to determine any variations in grain size, (3) to determine any variations in grain composition, (4) to evaluate surface vegetation which would affect the infrared spectra, and (5) to determine variations in moisture content of the sands. The results of the five points of inquiry are summarized, and detailed data are presented in graphs. F.O.S.

N69-30686*# Northwestern Univ., Evanston, Ill. Dept. of Geology.
VARIANCE OF SOME SELECTED ATTRIBUTES IN GRANITIC ROCKS
E. H. Timothy Whitten 4 Oct. 1968 29 p refs
(Grant NGR-14-007-027)
(NASA-CR-101747; Rept-18) Avail: CFSTI CSCL 08G

That predictive models developed for one rock unit do not necessarily apply to another broadly-analogous rock unit is demonstrated. Because many attributes can be measured more precisely, accurately, and cheaply than others, the more difficult attributes should be predicted from those more easily measured. Two important reasons presented for investigating the extent to which observed data can be used to predict other attributes are: (1) prospecting and evaluation in economic geology, and (2) rapidly developing field of remote sensing of environment on earth and in space. It is concluded that more geologists should research these subjects and make these data available. F.O.S.

N69-30745*# Ryan Aeronautical Co., San Diego, Calif.
SCATTEROMETER DATA ANALYSIS PROGRAM Final Report, 18 Oct. 1967–31 May 1968
May 1968 75 p refs
(Contract NAS9-6059)
(NASA-CR-101775; Rept-57667-3) Avail: CFSTI CSCL 08C

Scatterometer data are able to identify sea state (ocean surface roughness) quantitatively and also several ice types, which are associated with ice thickness. Two sea-state missions were flown, one to Newfoundland and one to Iceland. The first mission resulted in data from 13-foot seas and the latter mission gave data on 9-, 19-, and 26-foot seas. The development of a low cost fully automated data processing system and new display techniques are discussed. Model theory can be used in data analysis for correlation of terrain features with signal characteristics. Preparations for reduction of 400 MHz scatterometer data include a study of its characteristics and capabilities, a preliminary error analysis, and a digital computer program for reducing data. Author

N69-30750*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NEUTRAL ATMOSPHERE COMPOSITION MEASUREMENT BETWEEN 133 AND 533 KILOMETERS FROM THE GEOPROBE ROCKET MASS SPECTROMETER
Jimmy E. Cooley and Carl A. Reber Jun. 1969 41 p refs
(NASA-TM-X-63599; X-621-69-260) Avail: CFSTI CSCL 04A

The number densities of He, N_2, O_2, and O in the altitude range from 133 to 533 km were determined by a magnetic mass spectrometer on a Javelin rocket at 12 hr. 59 min. 42 sec. E.S.T. March 2, 1966. The instrument was under vacuum when launched and exposed to the ambient atmosphere by means of a pyrotechnique breakoff device. The ion source was enclosed in a chamber (silver oxide coated to enhance recombination of O into O_2) and samples the atmosphere through a knife-edged orifice. The He and N_2 concentrations agree well with the CIRA 1965 model above 250 km, while the model values of O and O_2 densities in the lower thermosphere are higher than the measured values. Integration of the N_2 altitude profile indicates an exospheric temperature of approximately 900°K during the flight. The O/O_2 ration was 10 at 210 km and the O/N_2 ratio was 1 at 265 km. Both He and N_2 were equally abundant at 300 km with a number density of 5.5×10^6 cm^{-3}. The atomic oxygen concentrations measured represent a lower limit to the ambient abundance since no correction was made for probable losses due to surface adsorption within the ion source and chamber. Author

N69-30778# International Atomic Energy Agency, Vienna (Austria).
NUCLEAR TECHNIQUES AND MINERAL RESOURCES
1969 518 p refs Proc. of the Symp. on the Use of Nucl. Tech. in the Prospecting and Develop. of Mineral Resources, Buenos Aires, 5–9 Nov. 1968
Avail: CFSTI

The conference proceedings focused on ore geophysics and processing, uranium exploration, radioisotope X-ray fluorescence, and activation analysis. For individual titles, see N69-30777 through N69-30806.

N69-30777# Institute of Nuclear Research, Krakow (Poland).
NEUTRON METHODS IN GEOPHYSICS
J. A. Czubek *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 3–21 refs (See N69-30778 17-13)
(SM-112/5) Avail: CFSTI

The applications of neutron methods in geophysics are compared with other nuclear methods in the light of recent progress. These methods are applied to the analysis of geophysical examples in field prospecting, borehole logging, and in the laboratory. The elements detected by nuclear geophysics methods are listed. The present trend is concentrated on quantitative information concerning the geological formations under investigation which can be treated by these methods. This claim can be fulfilled if the theory of each method is elaborated for the different rock and ore media. Problems

discussed are: (1) the problem of the slowing-down length of fast neutrons in rock media; (2) difficulties with the thermal neutron diffusion parameter for rocks; (3) the influence of rock heterogeneity on the response of neutron methods; and (4) some comparison between theory and experiment for the neutron–neutron method. The two main fields of application of the neutron methods are in oil geophysics and ore geophysics. Recent developments in these fields are outlined, and some remarks are made on neutron soil moisture measurements (calibration curve, range, etc.). Author

N69-30778# Atomic Energy of Canada, Ltd., Ottawa (Ontario).
DETERMINATION OF ORE CONCENTRATION IN EXPLORATION HOLES BY THE GAMMA-RAY BACKSCATTERING TECHNIQUE
D. K. Donhoffer *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 23–35 refs (See N69-30776 17-13)
(SM-112/2) Avail: CFSTI

The gamma ray backscattering technique was applied to the determination of zinc concentration in exploration holes in a zinc-lead mine. The special geological situation allowed the calculation of calibration curves for different sources and source detector geometries. The ^{60}Co, ^{137}Cs and ^{75}Se were used as gamma-sources, the best results being obtained using ^{137}Cs. Different probe lengths were investigated, and the optimal configuration was determined in test measurements in the mine. Measurements were carried out with the optimized probe in drill holes, for which the zinc concentration had already been determined by core sampling techniques and chemical analyses. The measurements from the backscattering technique were evaluated by calculated calibration curves. Very good agreement of the results was obtained in comparison with the chemical drill analyses. The mean deviation for a typical borehole of 50°m length was 1%. The backscatter probe was used in connection with a portable ratemeter. The time constant used was 15 s. The statistical accuracy of the count-rate measurement was better than 0.5%. The speed of the measurements was about 25 m/h. The total length of investigated boreholes was 940 m. Author

N69-30779# Institute of Nuclear Research, Krakow (Poland).
INFLUENCE OF BOREHOLE CONSTRUCTION ON THE RESULTS OF SPECTRAL GAMMA-LOGGING
J. A. Czubek *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 37–53 refs (See N69-30776 17-13)
(SM-112/3) Avail: CFSTI

In a quantitative interpretation of gamma-logging results, the absorption of gamma radiation in drilling fluid, casing tubes, cement or in the mud cake must be taken into account. This absorption is generally described as the transmission factor which is the ratio of the radiation passing through the absorbers in the borehole in relation to the incident beam of radiation from the rock. The transmission factor considered for a given photon energy is called the spectral transmission factor. To obtain good agreement between the theory and the experiment one must take into account some build-up of radiation from the forward scattered gamma-photons. It is the aim to derive formulas for the spectral transmission factor for the cylindric and plane absorbers. Comparison of the theoretical values of spectral transmission factor with the experimental ones, obtained in the uranium ore model, for the iron and aluminium absorbents of different thicknesses, gave an excellent agreement between the theory and experiment in the whole range of the photon energy. Special nomograms for the rapid calculation of the spectral transmission factor values are given. Author

N69-30782# Nuclear Enterprises, Ltd., Edinburgh (Scotland).
NUCLEONIC SOIL DENSITY AND MOISTURE GAUGES
J. F. Cameron *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 81–104 refs (See N69-30776 17-13)
(SM-112/6) Avail: CFSTI

Nucleonic moisture and density measuring equipment was developed for rapid, accurate, and nondestructive in situ measurements of the moisture content and density of soils and other minerals, under field conditions. Moisture is measured with neutron gages and density with gamma ray transmission or backscatter gages. The theory, application, and limitations of the technique are reviewed. Author

N69-30783# Institute of Nuclear Research, Krakow (Poland).
ENERGY DISTRIBUTION OF SCATTERED GAMMA-RAYS IN NATURAL GAMMA-LOGGING
J. A. Czubek and A. Lenda (Inst. of Nucl. Tech., Krakow, Poland) *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 105–116 refs (See N69-30776 17-13)
(SM-112/8) Avail: CFSTI

Natural gamma-logging is one of the most fundamental and most widely used methods in nuclear geophysics. It is most helpful for the lithological estimation and for evaluating the concentration of radioactive elements in rocks. One of the problems connected with this method which still remains unsolved is the question of the units in which the results of the measurements should be expressed. The main interest in such measurements is the concentration of radioactive material, and as a result of the measurements one obtains the gamma-radiation intensity, which is determined by the concentration and is strongly influenced by factors such as the type of detector, the geometrical and absorptive characteristics of the borehole and the chemical composition of the rock, which causes a variation of the photoelectric absorption coefficient with the equivalent atomic number of the medium. Details are given of the first steps in the long-term research being carried out. This research, which will cover both theory and experiment, aims to find the proper conditions for an equivocal relationship between measured intensity and concentration which for Clark's abundances of the radioactive elements in rock is one of the factors determining its lithological origin. Author

N69-30784# Natal Univ., Durban (South Africa). National Inst. for Metallurgy Research Group.
DYNAMIC TESTING OF MINERAL PROCESSING EQUIPMENT USING RADIOISOTOPES
R. P. King, E. T. Woodburn, R. P. Colborn, R. Edwards, and W. E. Smith (Atomic Energy Board, Pelindaba, South Africa) *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 117–127 refs (See N69-30776 17-13)
(SM-112/34) Avail: CFSTI

Processing of low grade ore deposits can only be economical if the processing is performed efficiently. This implies a thorough understanding of the process so that proper control and operating strategies may be adopted, and in this connection the dynamic response is an important aspect of a process. Radioisotopes are particularly valuable as tracers for the determination of the dynamic response. The dynamic testing of a mineral flotation cell in which a phosphate mineral is separated is described. The dynamic response of the solid phase in the cell was obtained by following the response to an injection of irradiated phosphate ore (^{32}P is the active constituent). The response of a liquid phase was obtained by following the response to an injection of short-lived ^{137}Ba produced by milking a ^{137}Cs cow. Details of the dynamic testing procedure and the production of the isotopes are discussed. The important question of the random noise associated with the isotope decay process is considered, and the design of a suitable digital filter for data smoothing is presented. The usefulness of such a filter is demonstrated by considering the frequency response of a typical process. Author

N69-30788# Geological Survey of Canada, Ottawa (Ontario).
TECHNIQUES CURRENTLY USED IN URANIUM PROSPECTING IN CANADA
H. W. Little and A. Y. Smith *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 131–145 refs (See N69-30776 17-13)
(SM-112/9) Avail: CFSTI

The sequence of existing practice in the search for uranium deposits in Canada begins with the establishment of a factual classification of types of uranium deposits and the criteria for recognition of the geological environment favorable to each type. The next step is the careful appraisal of geological maps and reports to determine regions and rock formations in which these criteria exist. Once a favorable region or formation is selected, initial field investigation is preceded by an airborne scintillometer or airborne gamma-ray spectrometer survey. Detailed geological mapping is usually done with special attention to the cause of anomalies. The form of geological studies is dependent on the type of uranium deposits. Detailed scintillometer grid surveys on the ground are used to pinpoint the targets to be surface trenched or diamond drilled. The drilling pattern is governed by the type of deposit. Research is being conducted into improved design and sensitivity of airborne gamma-ray spectrometry, and airborne magnetometers. Geochemical research is being undertaken on the behavior of uranium ions, in stream sediments, in soils, and in surface waters, relative to their use in prospecting for uranium deposits. Recent analyses for radon in surface waters has shown a closer relationship between radon anomalies and uranium deposits than uranium anomalies in surface waters. Radon was used sucessfully to trace dykes covered by glacial overburden. Both uranium content of stream sediments and radon content of surface waters are being used as tools in uranium prospecting. Author

N69-30787# Rice Univ., Houston, Tex.
TOTAL AND SPECTROMETRIC GAMMA-RAY SURVEYS FROM HELICOPTERS AND VEHICLES
J. A. S. Adams *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 147–161 refs (See N69-30776 17-13)
(Contract AT(05-1)-935)
(SM-112/10) Avail: CFSTI

A single-channel gamma-ray spectrometer was built and tested in surveys from the air and vehicles. Using a 5 in. × 5 in. sodium iodide (thalium-activated) scintillation crystal, thorium, uranium, and potassium anomalies can be detected in the upper 10 to 25 cm of soil or rock. Thorium and uranium anomalies are of interest as pathfinder elements to locate and define placer deposits, changes in lithology, changes in sedimentary facies, and differences in soil type, e.g. tropical iron and aluminum ores. Anomalies containing as little as 6 ppm thorium and 3 ppm uranium as determined by analysis of ground samples were readily detected against a background of beach sand containing 1 to 2 ppm thorium and 0.3 to 0.6 ppm uranium at ground speeds of 105 km/h (60 knots) and elevations of 17 ± 1 m. The relative contributions of thorium or uranium to a particular total gamma ray anomaly were successfully measured by gamma-spectrometry from the air at the above altitudes and ground speeds. The instrumentation has application for the direct exploration for potassium, thorium, and uranium, and for the pathfinder applications, e.g. bedded phosphates that contain over 10 ppm uranium and placer deposits that contain twice background thorium or uranium. In evaluating placers, a combination of gamma-ray and aeromagnetic techniques is advantageous because many placer deposits contain enough ilmenite and magnetite to give a detectable aeromagnetic anomaly under the conditions of the gamma ray survey. The aeromagnetic anomaly will arise from minerals at much greater depths than is the case with the gamma ray anomaly. Author

N69-30788# Texas Instruments, Inc., Dallas.
IMPROVEMENT IN AIRBORNE GAMMA-RADIATION DATA ANALYSES FOR ANOMALOUS RADIATION BY REMOVAL OF ENVIRONMENTAL AND PEDOLOGIC RADIATION CHANGES
R. S. Foote *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 187–196 (See N69-30776 17-13)
(SM-112/13) Avail: CFSTI

Analysis of airborne gamma-radiation spectral data gathered from an array of 11-1/2-in.-diam. by 4-in.-thick NaI(Tl) detectors provides isoradiation maps of the average surface concentrations of uranium (^{214}Bi), thorium (^{208}Tl) and potassium (^{40}K) only if aircraft and atmospheric radiations are properly measured and removed. The atmospheric radiation consists of ambient, diurnal and surface pedologic components. Airborne measurement of the average radiation along a flight line indicates ^{208}Tl and ^{40}K surface intensities to be consistently measured to ± 2%. Airborne measurement of ^{214}Bi intensities at 400-ft surface altitude indicates that as much as 70% of the data originates in the atmosphere as a result of the decay of atmospheric radon concentrations. These atmospheric ^{214}Bi intensities are being measured and removed from the data. Much data have been accumulated indicating the specific correlation between the average intensities of radiation from the decay of the natural radionuclides within pedologic environments. Digital data gathered from a magnetic tape multichannel analysis system can be reduced by computer operation to give isoradiation maps that indicate regions of anomalous radiation where the effects of surface pedologic changes are minimized or removed. This analysis separates desired anomalies from those created by surface pedologic changes. Author

N69-30789# Atomic Energy Commission Research Establishment, Riso (Denmark).
USE OF FIELD GAMMA-SPECTROMETRY IN THE EXPLORATION OF URANIUM AND THORIUM DEPOSITS IN SOUTH GREENLAND
L. Lovborg, H. Kunzendorf, and J. Hansen (Copenhagen Univ.) *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 197–211 refs (See N69-30776 17-13)
(SM-112/14) Avail: CFSTI

The gamma-spectrometry method for field determination of uranium and thorium was studied on the basis of 69 single measurements with a portable gamma-spectrometer in the Ilimaussaq intrusion, south Greenland. This intrusion is composed mainly of peralkaline syenites such as naujaites, lujavrites, etc. The lujavrites are characterized by large contents of uranium, thorium, and other rare elements. The radioactive minerals comprise a uranium-rich variety of monazite, steenstrupine, eudialyte and thorite. Radioactivity occurs in pigmentary material as a result of adsorption of uranium to iron oxides. The portable gamma spectrometer consisted of a scintillation detector equipped with an uncollimated 2-in. diam. x 2-in. NaI(Tl) crystal and a single-channel pulse-height analyzer. Rock samples from the field localities were crushed and spectrophotometrically analyzed for uranium and thorium. The gamma-spectra of the crushed samples were at the same time measured in the laboratory. Both the field and the laboratory gamma-spectrometer data were correlated with the sample contents of uranium and thorium on the basis of linear regression analysis. The results obtained in the treatment of the laboratory gamma-spectrometer data indicated that ^{238}U and ^{232}Th were both in secular equilibrium with their daughters. The fluctuations of the field gamma spectrometer data about the expected mean values of these data were very large, and were ascribed to the heterogeneities characterising the distribution of uranium and thorium in the rocks. Author

N69-30790# Gearhart-Owen Industries, Inc., Fort Worth, Tex.
GAMMA-RAY LOGGING IN URANIUM PROSPECTING
W. K. Hawkins and M. Gearhart *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 213–222 refs (See N69-30776 17-13)
(SM-112/15) Avail: CFSTI

Gamma ray systems that have a wide range response are required for uranium exploration. Low grade ore bodies with marginal economic feasibility are particularly dependent on reliable, calibrated gamma ray logs. Wide range gamma ray counting systems for this purpose are described, with emphasis on the downhole wide range gamma-gross count probe. Gamma detector types, calibration of the system, and interpretation methods are reviewed. The hardware characteristics are detailed to provide an understanding of equipment capabilities and limitations. It is necessary to discriminate between the valuable uranium ore and other radioactive materials, at present of little value. Gamma spectral logs are of considerable interest but available equipment limits the use of such techniques. Equipment limitations and possible improvements are covered. Author

N69-30791# Institute of Nuclear Research, Krakow (Poland).
SELECTIVE NATURAL GAMMA LOGGING [RADIOCAROTTAGE GAMMA NATUREL SELECTIF]
J. A. Czubek and P. Dumesnil (Centre d'Etudes Nucleaires, Saclay) *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 223–248 refs In FRENCH; ENGLISH summary (See N69-30776 17-13)
(SM-112/16) Avail: CFSTI

Natural gamma logging can be used for determining the bismuth-214 content of uranium-bearing rocks. The principle of the new technique of selective natural gamma logging is the use of the photoelectric effect due to the presence of uranium in rock. Natural gamma radiations are emitted but then scattered by the ore. The presence of uranium causes a change in the shape of the scattered gamma spectrum and this change can be related to the uranium content. The authors show that, if one applies the similitude principle to the transport equation for gamma radiation, the numerical value of a certain parameter representing the ratio of the number of counts obtained in two bands I_1 and I_2 of the scattered gamma spectrum, depends on the value of the equivalent atomic number of the rock. The first laboratory tests were carried out on concrete models of uranium ore. In laboratory conditions the degree of error is between 10 and 20% for contents of about 0.5%. A field survey rig mounted on a lorry was developed. It comprises a NaI(Tl) scintillator probe and, at the surface, two single-channel selectors used for definition of bands I_1 and I_2, and a spectrum stabilizer. Two scalers and two linear count-rate meters coupled to a two-channel potentiometric recorder were used for obtaining the counting rates for I_1 and I_2 at a fixed point, together with the log corresponding to these quantities. This surface electronic equipment was made up of standard Renatran elements. The aggregate was mounted on a laboratory lorry with all necessary equipment for prospecting work. Author

N69-30793# Comitato Nazionale per l'Energia Nucleare, Rome (Italy). Laboratorio Geominerario.
USE OF THE METHOD OF RECORDING FISSION PRODUCTS IN INSULATING MATERIAL TO STUDY URANIUM AND THORIUM DISTRIBUTION IN ROCKS AND MINERALIZATIONS [UTILISATION DE LA METHODE D'ENREGISTREMENT DES FRAGMENTS DE FISSION DANS LES ISOLANTS POUR L'ETUDE DE LA REPARTITION DE L'U ET DU TH DANS LES ROCHES ET DANS LES MINERALISATIONS]
Silvia Sircana and G. Gloria *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 255–268 refs In FRENCH; ENGLISH summary (See N69-30776 17-13)
(SM-112/19) Avail: CFSTI

An alternate method for isolating the fission fragments of U and Th and for directly distinguishing the distribution of radioactive tracks in rock samples and monominerals was described. Results are independent of the radioactive state of the sample, the need for a large sample, and the method is nondestructive. As a fission fragment detector, a polycarbonate product was found suitable for studying track distribution in thin sections (10-40 μ) and polished sections of rock. Counting of tracks under the optical microscope, the only time-consuming aspect of the method, could be automated for routine measurement. M.H.E.

N69-30794# United Kingdom Atomic Energy Authority, Wantage (England). Research Lab.
APPLICATIONS OF RADIOISOTOPE X-RAY FLUORESCENCE ANALYSIS IN GEOLOGICAL ASSAY, MINING AND MINERAL PROCESSING
C. G. Clayton *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 293–324 refs (See N69-31776 17-13)
(SM-112/20) Avail: CFSTI

Nondispersive radioactive isotope X-ray fluorescence techniques, equipment, and applications are reviewed. The only analytical problems in geological assay, mining, and mineral processing limiting accuracy were inter-element and particle-size effects. Radiation detectors and solid state devices used simultaneously allowed multielement analyses in the fields and field laboratories. Pilot plant studies demonstrating high accuracy and reliability of these techniques compared to conventional X-ray spectrometers were documented. The success of portable equipment and on-line systems in cement and coal processing plants was discussed against the limitations of the surface sampling and crushed sampling techniques. M.H.E.

N69-30796# Institute of Nuclear Techniques, Krakow (Poland).
FIELD DETERMINATION OF IRON USING X-RAY FLUORESCENCE AND GAMMA-RAY SCATTERING
B. Dziunikowski and J. Niewodniczanski *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 343–351 refs (See N69-30776 17-13)
(SM-112/22) Avail: CFSTI

In exploiting a strip mine, the concentration of the element of interest is sometimes controlled by shallow pilot boreholes, particularly in the case of an irregular deposit. It is desirable that the cores should be analyzed directly in the field rather than in the laboratory. Two radiometric methods for such a determination of iron in ore are described; radioisotope X-ray fluorescence, and the scattering of gamma rays with energy less than 100 keV. Author

N69-30798# Bureau of Mines, College Park, Md. Metallurgy Research Center.
RADIOISOTOPIC X-RAY ANALYTICAL TECHNIQUES FOR GOLD AND SILVER ORES
P. G. Burkhalter *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 365–379 refs (See N69-30776 17-13)
(SM-112/18) Avail: CFSTI

The purpose of this investigation was to determine the sensitivity of radioisotopic, energy dispersion X-ray techniques using semiconductor detectors for silver and gold ores. The excellent pulse resolution of the semi-portable silicon and germanium semiconductor detectors offer a rapid and sensitive method for on-line X-ray analysis of drill hole cores, ocean sediments, and ore processing concentrates. The sensitivity for silver was measured under optimum laboratory conditions with a 3-mm × 80-mm^2 Si

semiconductor with a FWHM pulse resolution of 1.22 keV for Ag Kα. Intensity measurements were obtained using both single-channel analysers and a 400-channel pulse-height analyser from samples containing 1000 ppm silver in a silica matrix. The measured peak-to-background ratio and calculated detection limits were used to compare radioisotopic sources, geometries, samples, and electronic discrimination techniques. A computer was used to calculate peak-to-background ratios and detection limits for preselected spectral energies and electronic discrimination, and to plot overlying standard and background intensities. The peak-to-background ratio versus different levels of electronic discrimination was compared for the various monoenergetic sources. Author

N69-30799# Ministerului Petrolului, Ploesti (Rumania).
NUCLEAR TECHNIQUES CURRENTLY USED IN OIL FIELD EXPLOITATION
G. Petcu *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 383–396 refs (See N69-30776 17-13)
(SM-112/24) Avail: CFSTI

A general survey is given of the present status and prospects of the techniques of nuclear geophysics, which are classified as follows: methods concerned with the investigation of geological formations, from the point of view of lithologic nature, content of clay, dolomite, anhydrite, etc., and based on the study of natural and induced radioactivity (making use of gamma and neutron radiation); methods concerned with petrophysical parameters (density, porosity, etc.), by means of which the collecting capacity of prospected geological formations can be qualitatively and quantitatively determined; methods for determining the nature of fluids present in deposits; and radiotracer methods, which are used extensively in the drilling, construction and operation of oil wells, and also in various techniques concerned with exploitation of deposits, and secondary recovery. Particular importance is given to the development of spectral analysis in the study of natural, scattered and induced gamma-radiation, and also to radioactive tracer techniques. Author

N69-30800# Mobil Research and Development Corp., Dallas, Tex. Field Research Lab.
ADVANCES IN NUCLEAR GEOPHYSICAL METHODS IN OIL GEOLOGY AND ROCK ANALYSIS
R. L. Caldwell, W. R. Mills, and W. W. Givens *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 397–413 refs (See N69-30776 17-13)
(Contract NASw-1435)
(SM-112/25) Avail: CFSTI

A summary is presented of a two year extensive study of the combination neutron method for analyzing surface rocks of the moon and planets. The combination method uses a pulsed accelerator source of 14-MeV neutrons and measurement of prompt gamma rays, capture gamma rays, activation gamma rays, and thermal and epithermal neutron die-away. As a result the new technique of cyclic neutron activation was developed which is applicable to lunar surface analysis, borehole logging, and on-stream analysis of rocks and minerals. Rock analysis studies have been made with a high resolution lithium-drifted germanium detector and a pulsed accelerator source of neutrons. The detector resolution of 0.5% at 1.3 MeV is about an order of magnitude better than for a good sodium iodide detector. Gamma rays arising from inelastic scattering of fast neutrons, capture of fast and slow neutrons, and activation were studied. From the results with the high resolution detector some interesting conclusions and speculations are made concerning the future of nuclear elemental analysis in the field. A new small-diameter pulsed accelerator neutron tool for logging through 2 1/2-in. tubing is described, and a pulsed neutron source using a plurality of alpha sources and beryllium targets with a rotatable shutter between them. Author

N69-30802# Michigan Univ., Ann Arbor. Dept. of Meteorology and Oceanography.
APPLICATION OF NEUTRON ACTIVATION ANALYSIS TO GEOCHEMICAL STUDIES OF MINERAL RESOURCES
J. W. Winchester and J. A. Cetoggio (La Plata Univ., Argentina) *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 435–449 refs (See N69-30776 17-13)
(SM-112/28) Avail: CFSTI

Sensitive and accurate measurement of closely related trace element concentrations in naturally occurring materials leads to the most useful geochemical information in the study of crystallizing systems. Studies of the rare earth elements have shown regularities that can be related to geological crystallization processes in igneous and sedimentary materials, and it is likely that similar studies of economic mineral deposits will lead to similar information. An analytical method should be chosen with great care to assure adequate sensitivity for the trace elements under investigation. Neutron activation analysis and spark source mass spectrometry both have high sensitivity adequate for many geochemical applications. However, simpler methods, such as atomic absorption, absorption spectrophotometry and electrochemical methods have adequate sensitivity for many elements and are preferred when suitable. Author

N69-30804# Texas A&M Univ., College Station. Activation Analysis Research Lab.
PRELIMINARY STUDY ON THE USE OF FAST-NEUTRON ACTIVATION ANALYSIS ON SEA-FLOOR COMPOSITIONAL MAPPING
G. G. Santos, L. E. Fite, W. E. Kuykendall, R. E. Wainerdi, A. H. Bouma et al *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 463–487 refs (See N69-30776 17-13)
(SM-112/30) Avail: CFSTI

The object of this investigation was to apply fast neutron activation to marine sediments for the purpose of characterizing chemical (elemental) compositional variations encountered on the ocean floor. A mapping of such variations should provide quantitative interpretation in terms of transport and lateral changes of deposition. Sediments, collected from different depositional environments of the Gulf of Mexico, were analysed by 14-MeV neutron activation analysis techniques. A maximum total output flux of 1×10^9 n/cm^2 s for 15 min. was employed. A lower output flux and longer irradiation periods were also used for comparison purposes. Measurements indicate that, on the basis of silicon content alone, abyssal plain sediments can be easily differentiated from those of the continental slope, abyssal hills, continental rise and the Mississippi Fan. The elements Fe, Mg, and Al are apparently silica dependent and may be used to gauge subtle variations within a particular depositional environment. Carbonate regions are distinguishable from the siliceous area. Although the analysis of the sediments has been accomplished using laboratory equipment, it should be feasible to perform the analysis in situ from a submersible, or from the surface, using a portable system. The pulse-height analyser, control system and readout equipment could be aboard the research vessel, and the neutron source and detection equipment could be in a remotely controlled pressure chamber, or the entire system could be miniaturized in form similar to that planned for extra-terrestrial missions. Author

N69-30813*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A STUDY OF ION COMPOSITION AND CHEMISTRY IN A QUIET, MIDDAY, MIDLATITUDE F-REGION FROM 180 to 308 KILOMETERS

M. W. Pharo, III, L. R. Scott, H. G. Mayr, and H. A. Taylor, Jr. Jun. 1969 22 p refs
(NASA-TM-X-63594; X-621-69-121) Avail: CFSTI CSCL 04A

Altitude profiles of ion composition and concentration at midday from 130 to 360 kilometers were measured by a rocket-borne ion mass spectrometer aboard NASA 18.06 above Wallops Island, Virginia, on August 28, 1966. Adopting Jacchia's 1964 neutral atmosphere model and previously published measurements of the EUV spectrum, the ion distributions are employed to deduce the reaction rates for the primary thermospheric processes under the assumption of photochemical equilibrium. This is accomplished by considering separately the particle balance for each ion species. Starting with the ion constituent least dependent on the others, a hierarchy is established that allows a systematic and almost unique determination of the rate coefficients, which is found to be comparatively low and within a factor of three of the values derived in laboratory experiments. This result is regarded as demonstrating general agreement, considering the range of uncertainties attributed to the laboratory rate coefficients and to the estimated photoionization and recombination rates. Author

N69-30881# Air Force Systems Command, Wright-Patterson AFB, Ohio. *Foreign Technology Div.

THE GRAPHIC REPRODUCTION OF A COORDINATE NETWORK ON A CATHODE-RAY TUBE USING A COMPUTER

E. S. Mednikova et al 4 Dec. 1968 15 p refs Transl. into ENGLISH from Tr. Nauchn.-Issled. Inst. Arkticheskiy i Antarkt. (Leningrad), v. 272, 1966 p 75–83
(AD-685023; FTD-HT-23-1041-68) Avail: CFSTI CSCL 8/2

Two methods are described for plotting a geographic network on the screen of a cathode-ray tube, using a computer. The first method involves the calculation of Cartesian coordinates of latitudes and longitudes based on formulas for a stereographic projection. The second method is based on the consideration of equations of isolines (latitude and longitude) described in Cartesian coordinates. The methods described can easily be extended to other types of projections. In principle, the method of plotting charts on a cathode-ray tube is similar to plotting charts with mechanical printers. However, due to the high resolution of the CRT, isolines appear as a continuous line. Formulas are derived for describing latitude and longitude in both methods, and two computer programs for the process are given. It is stated that the time required to plot a network using the first method is 1 min 30 sec when the pole falls outside the screen limit. With the pole on the screen, the time is about 3 min. For the second method, the times are 30 and 42 sec, respectively. A geographic network produced on a CRT can be used as a datum to which weather data can be related in order to obtain weather charts or isoline charts. TAB

N69-30921# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

SIMULTANEOUS DETERMINATION OF VERTICAL COMPONENT xi AND eta WITH THE PRISMATIC ASTROLABE. PART 3: OBSERVATIONS AT THE FIRST-ORDER TRIANGULATION STATIONS BREKENDORF, BREMEN, HOYERHAGEN, ITZEHOE, KLINTUM, MEHLBY-ROEST, NEIDERREIFENBERG, NINDORF, NINDORF-MELDORF, OSTENFELD, SUEDERSCHMEDEBY, WALLE UND WELMBUETTEL IN 1958 [SIMULTANBESTIMMUNGEN DER LOTABWEICHUNGSKOMPONENTEN xi UND eta MIT DEM PRISMENASTROLABIUM. 3: BOEBACHTUNGEN AUF HAUPTDREIECKSPUNTEN BREKENDORF, BREMEN, HOYERHAGEN, ITZEHOE, KLINTUM, MEHLBY-ROEST, NIEDERREIFENBERG, NINDORF, NINDORF-MELDORF, OSTENFELD, SUEDERSCHMEDEBY, WALLE UND WELMBUETTEL IM JAHRE 1958]

Gunther Zimmerman 1967 30 p refs In GERMAN; ENGLISH summary *Its* Pamphlet No. 128
(Rept-89) Avail: CFSTI

The astro-geodetic determination of deviations from the vertical, started in 1956 and continued in 1957 near the Saint Gotthard meridian, was continued northward at these stations of primary triangulation in the North German plain up to the Danish border. In addition to listing the tabulated data for these stations, this paper describes the observation techniques and the star program. Transl. by K.W.

N69-30922# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

SIMULTANEOUS DETERMINATION OF THE VERTICAL DEVIATION COMPONENTS xi AND eta WITH THE PRISMATIC ASTROLABE. PART 7: OBSERVATIONS ON THE FIRST-ORDER TRIANGULATION STATIONS BRUCHHAUSEN, DALUM, DAMME, DEILINGHOFEN, EMMERZHAUSEN, HATZFELD, HERSCHEID, HORSTMAR, HORTSTMAR, IPPINGHAUSEN, KEVELAER, LAMMERSDORF, LEER, NIEDERREIFFENBERG, OESEDE, SECHTEM-WALBERBERG, TITZ, TRIER-EUREN, VELBERT, WALLENBORN, WANGEROOGE, WERPELOH AND ZUESCHEN IN 1965 [SIMULTANBESTIMMUNGENDER LOTABWEICHUNGSKOMPONENTEN xi UND eta MIT DEM PRISMENASTROLABIUM. 7: BEOBACHTUNGEN AUF DEN HAUPTDREIECKSPUNKTEN BRUCHHAUSEN, DALUM, DAMME, DEILINGHOFEN, EMMERZHAUSEN, HATZFELD, HERSCHEID, HORSTMAR, IPPINGHAUSEN, KEVELAER, LAMMERSDORF, LEER, NIEDERREIFENBERG, OESEDE, SECHTEM-WALBERBERGE, TITZ, TRIER-EUREN, VELBERT, WALLENBORN, WANGEROOGE, WERPELOH UND ZUESCHEN IM JAHRE 1965]

Adolf Rodde 1969 88 p refs In GERMAN; ENGLISH summary *Its* Pamphlet No. 163
(Rept-168) Avail: CFSTI

The astronomical determinations performed in 1965 on 22 first-order triangulation stations in the north and west of the West German part of the European triangulation net are described. The data observed at these stations are presented in tables and include star time, ephemerides, number of stars and mean observation error, corrected components Ξ and η of the deviation from the vertical, and improved zenith distances. Transl. by K.W.

N69-30930# Defence Research Board, Ottawa (Ontario).

ADSORPTIVE MECHANISM FOR LOSS OF THE MOON'S ATMOSPHERE

A. M. Gutkin et al May 1969 4 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 182, no. 6, 1968 p 1294–1295
(T-514-R) Avail: CFSTI

Theories related to the liberation of volatile substances on the lunar surface by volcanic activity and other gas generating processes are briefly described, as related to the role that these processes play in local surface heating and evaporation of surface material. It is emphasized that radio-astronomical and optical observations indicate that the thermal dissipation of gasses cannot explain the nearly complete absence of lunar atmosphere and that the effects of surface gas adsorption must be taken into account. The adsorptive properties of the lunar surface and the conditions which produce gas removal are then briefly postulated. A.C.R.

N69-30941# Trieste Univ. (Italy). Inst. of Geodesy and Geophysics.

NON LINEAR ELASTICITY IN THE FREE OSCILLATIONS OF THE EARTH AS REVEALED BY SPECTRAL AND BISPECTRAL ANALYSIS Final Technical Report, Jan. 1966–Apr. 1968

A. Marussi, M. Bozzizadro, and G. Manzoni Apr. 1968 57 p refs
(Contract DA-91-591-EUC-3960)
(AD-685042) Avail: CFSTI CSCL 8/11

In the present report the stationary waves following the Chilean earthquake of May 22, 1960, as recorded by the pair of horizontal pendulums situated in the Earth Tides Station of the Grotta Gigante near Trieste, are examined. Three distinct results have been achieved in the analysis of these records: (1) determination of the periods of the spheroidal and torsional modes by means of spectral analysis, and their comparison with the corresponding theoretical periods for the linear elastic models Gutenberg-Bullen A and Gutenberg-Bullen B; (2) determination by comparison of the spectral energies of successive sections of the spectrum of the Q parameter of the dissipation of energy due to departures from the elastic behavior in the terrestrial body; (3) determination by means of bispectral analysis of the interaction modes which are generated by the normal modes on account of the departures from the linear elastic behavior of the earths body. With the scope of examining the origin and the nature of the interaction modes, Part I deals with the theory of the finite elastic deformations both in a system of n degrees of freedom and in a continuous system. Part II presents the results of the three analyses cited above. Taking advantage of the theoretical results obtained in Part I, one can estimate intervals allowable for the three new elastic parameters which, along with the Lame parameters of the classical theory, rule the anelastic behavior of the terrestrial body. TAB

N69-30962# Arctic Inst. of North America, Washington, D.C.
GREENLAND ICE CAP NOISE STUDIES PROJECT BLUE ICE Final Report
R. A. Lenton Jun. 1968 111 p
(Contract AF 49(638)-1722)
(AD-676011; AINA-RP-47) Avail: CFSTI CSCL 8/11

Seismic noise studies on the Greenland ice sheet were conducted as part of the VELA uniform basic research program under the code name Project Blue Ice. The station on the ice cap showed low-noise levels and low coherences between seismographs indicating that a large array would be an effective tool in detection. Emplacement of the seismometers in shallow holes eliminated the noise associated with high wind velocities. At the 50% probability of detection level, a single seismometer at the station has a detection capability of at least magnitude 4.3. The long-period noise levels were comparable with average sites on the continents. In addition to the major experiment, other scientific programs were conducted in the fields of glaciology, magnetics, gravity, and air pollution. Author (TAB)

N69-31011# Texas Univ., Austin. Antennas and Propagation Lab.
THE CORRELATION OF THE SCATTERING CROSS-SECTIONS OF THE DISTURBED INDEX OF REFRACTION AND THE ACCELERATION INCREMENT OF A CONVENTIONAL AIRCRAFT DUE TO CLEAR AIR TURBULENCE
C. R. Griffin, Jr. and A. H. Lagrone 28 May 1968 28 p refs
(Grant NSF GA-772)
(AD-675647; P-28) Avail: CFSTI CSCL 4/1

The theoretical relationship between the effective radar back-scattering cross-section for regions of atmospheric turbulence and the mechanical energy of the turbulence is developed along the lines of existing theory. The cross-section formula is developed in terms of two parameters: the mean gradient of refractive index fluctuations in turbulence, and mean squared velocity fluctuations. Next the response of a conventional aircraft, in terms of load factor, to vertical components of velocity is determined and the substitution of parameters which is effected results in an expression for turbulence scattering cross-section in terms of mean squared load factors measurable from an aircraft, and refractive index gradient, also measurable from an aircraft. A method is thus obtained for verifying the theory of homogeneous turbulence and associated scattering theory by simultaneous measurement of radar cross-section parameters from an aircraft in the turbulence and by a ground based radar set. Author (TAB)

N69-31029# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
TELLUROMETRIC MEASUREMENTS OF THE INSTITUTE FOR APPLIED GEODESY ON TRIANGULATION SIDES I. O. IN THE AREA HANNOVER GOETTINGEN-HAMM. THE TRIANGULAR NET IN THE AREA HANNOVER-GOETTINGEN-HAMM [TELLUROMETERMESSUNGEN DES INSTITUTS FUER ANGEWANDTE GEODAESIE AUF DREIECKSSEITEN I. O. IM RAUM HANNOVER-GOETTINGEN-HAMM. DAS DREIECKSNETZ IM RAUM HANNOVER-GOETTINGEN-HAMM]
Hermann Dirk and Dieter Ehlert 1967 108 p refs In GERMAN; ENGLISH summaries *Its* Ser. B: Appl. Geodesy, Pam. No. 142 (Rept-94) Avail: CFSTI

CONTENTS:

1. TELLUROMETRIC MEASUREMENTS OF THE INSTITUTE FOR APPLIED GEODESY ON TRIANGULATION SIDES I. O. IN THE AREA HANNOVER-GOETTINGEN-HAMM p 7–16 refs (See N69-21030 17-13)
2. THE TRIANGULAR NET IN THE AREA HANNOVER-GOETTINGEN-HAMM p 17–60 (See N69-31031 17-13)

N69-31030# Institut Fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
TELLUROMETRIC MEASUREMENTS OF THE INSTITUTE FOR APPLIED GEODESY ON TRIANGULATION SIDES I. O. IN THE AREA HANNOVER-GOETTINGEN-HAMM. [TELLUROMETERMESSUNGEN DES INSTITUTS FUER ANGEWANDTE GEODAESIE AUF DREIECKSSEITEN I. O. IM RAUM HANNOVER-GOETTINGEN-HAMM]
Hermann Dirk *In its* Tellurometric Meas. of the Inst. for Appl. Geodesy on Triangulation Sides I. O. in the Area Hannover-Goettingen-Hamm. The Triangular Net in the Area Hannover-Goettingen-Hamm 1967 p 7–16 refs In GERMAN; ENGLISH summary (See N69-31029 17-13)
Avail: CFSTI

Following the base-line measurement near Göttingen in 1961 the Institut für Angewandte Geodäsie (IfAG) has performed tellurometer measurements in the years 1961–1968 on 25 primary triangulation sides west of the base extension net near Göttingen in the area Hannover–Göttingen–Hamm. The tellurometer network extends over parts of 3 chains and 2 supplementary networks of the German primary triangulation net and covers parts of 3 federal states. The author informs on the results of the measurements and the accuracy obtained. Author

N69-31031# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE TRIANGULAR NET IN THE AREA HANNOVER–GOETTINGEN–HAMM [DAS DREIECKSNETZ IM RAUM HANNOVER–GOETTINGEN–HAMM]

Dieter Ehlert *In its* Tellurometric Meas. of the Inst. for Appl. Geodesy on Triangulation Sides I. O. in the Area Hannover–Goettingen–Hamm. The Triangular Net in the Area Hannover–Goettingen–Hamm 1967 p 17–60 In GERMAN; ENGLISH summary (See N69-31029 17-13)
Avail: CFSTI

As preliminary work for the new adjustment of the European Triangulation Network parts of the German Primary Triangulation Net (HDrN) with an unfavorable configuration were adapted to nowadays requirements by means of complementary measurements Author uses the observations for accuracy investigations and minor adjustments in order to draw conclusions on their possible use in a large area adjustment. Special emphasis is placed on the determination of observation weights and on the establishment of the effects resulting from a wrong weight introduction. The significance of additionally measured distances of minor accuracy in trigonometric nets is shown. Author

N69-31038# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MEASUREMENTS OF ELECTROMAGNETIC PULSE PROPAGATION IN VARIOUS SOILS
Michael L. Burrows 20 Aug. 1968 12 p
(Contract AF 19(628)-5167)
(AD-675292; TN-1968-30; ESD-TR-68-247) Avail: CFSTI CSCL 8/13

Measurements of the propagation velocity and attenuation of 2.5, 5, and 10 ns pulses in various soils with varying water contents have been made by packing the soils into a specially built coaxial line. From the table of results it is also possible to infer qualitatively the amount of pulse dispersion. The soils tested range from pure sand, which is essentially nondispersive and has low attenuation, through various loams of moderate dispersion and attenuation to the highly-dispersive, highly-attenuating pure clays. Author (TAB)

N69-31046# Army Electronics Command, Fort Monmouth, N.J.
REMARKS ON THE MATCHING OF TOPSIDE AND BOTTOMSIDE ELECTRON DENSITY PROFILES OF THE IONOSPHERE
P. R. Arendt Feb. 1969 17 p refs
(AD-684914; ECOM-3077) Avail: CFSTI CSCL 4/1

Limits for deviation from matching are assumed to be less critical when ionospheric stratification applies. However, a case of good matching was observed during a magnetic storm. The reported observations are not conclusive: good matching occurred with poor time coincidence; however, relatively poor matching occurred with good position and time coincidence. Layer tilting and horizontal fine structure have to be studied in more detail. Author (TAB)

N69-31056*# Stanford Univ., Calif. Remote Sensing Lab.
REEVALUATION OF THE NORMATIVE MINERALS OF SONORA PASS ROCK STANDARDS; UNIVERSITY OF NEVADA REPORTS 7 AND 12
I. A. Kilinc and R. J. P. Lyon 16 Nov. 1968 46 p refs
(Contract NAS9-7313)
(NASA-CR-101787; SU-RSL-TECH-68-2) Avail: CFSTI CSCL 08G

The chemical analyses and normative minerals of a number of rock samples collected from Sonora Pass NASA Test Site were published by the University of Nevada in their Technical Letters. A closer examination of the normative minerals obtained from several chemical analyses revealed that the method of calculation of normative minerals was not correct. Specifically, the weight percent sum of the normative minerals and the weight percent sum of oxides from which the norms were calculated was found to vary as much as 18 percent. Since the calculation of normative minerals involves rearrangement of the oxides in the form of pure minerals, the two sums should not deviate by more than one percent. Author

N69-31063*# Nevada Univ., Reno. Mackay School of Mines.
MT. LASSEN TEST SITE NO. 56 Preliminary Ground Truth Report
Peter E. Chapman, Peter A. Brennan, Jack G. Quade, Pat Robertson, David Nicolarsen et al 14 Aug. 1967 21 p refs
(Contract NAS9-7044)
(NASA-CR-101798; TR-8) Avail: CFSTI CSCL 08G

The cinder cone area of Mt. Lassen was selected as a test site because it provided an excellent target for microwave and infrared by eliminating many of the parameters that contribute to the total signal. The almost total absence of vegetation reduces biospheric interference to a minimum, while a variation of approximately 100 feet in topography eliminates slope problems effecting the microwave. Lakes provide an excellent source for calibration while the usually dry air should reduce total moisture in the ground-to-plane interface which effects the infrared. The effects of surface roughness, porosity, thermal conduction and size distribution characteristics to the total signal on the microwave and infrared portions of the spectra were observed. Author

N69-31066*# National Meteorological Center, Suitland, Md.
WEEKLY SYNOPTIC ANALYSES 5-, 2-, AND 0.4-MILLIBAR SURFACES FOR 1966
Jan. 1969 173 p refs
(NASA Order P-32290-G)
(NASA-CR-103266; WB-9) Avail: SOD $1.50; CFSTI CSCL 04A

Data from meteorological rocketsonde observations, in addition to high-level rawinsonde observations were employed to analyze a series of 5-, 2-, and 0.4-mb charts. Methods employed for processing the various types of data as well as the analysis procedure are described. The broad-scale analyses, primarily covering North America and adjacent ocean areas, are presented at weekly intervals for 1966. A brief discussion of the circulation and temperature patterns in the middle and upper stratosphere, as indicated on the charts, is also given. Author

N69-31076*# Texas A&M Univ., College Station. Dept. of Oceanography.
MICROWAVE RADIOMETRY AND ITS APPLICATIONS TO MARINE METEROLOGY AND OCEANOGRAPHY
Jack Frederick Paris Jan. 1969 236 p refs Sponsored by NASA
(Contract Nonr-2119(04); A&M Proj. 286-13; Proj. NR-083-036)
(NASA-CR-103237) Avail: CFSTI CSCL 08C

Microwave radiometry is reviewed to establish a continuity between applications of microwave physics and engineering to marine meteorology and oceanography. Molecular oxygen, water vapor, and liquid water absorb, emit, and scatter microwave radiation. The ocean reflects or scatters a majority of the microwave radiation incident upon its surface and emits microwave energy. These functional relationships and the physics of the atmosphere and hydrosphere are described. The emission of sea water is almost constant with temperature and salinity for frequencies of 8 GHz to 30 GHz, is linearly proportional to temperature near 5.4 GHz, and is strongly dependent upon salinity near 1 GHz. Sea foam causes greatly increased microwave emission. Atmospheric water vapor affects the absolute value of upwelling microwave radiation greatly near 22.235 GHz. Atmospheric attenuation and emission are predictable for frequencies less than 8 GHz. Measurements near 5.4 GHz and 1 GHz may be used to survey temperature and salinity of coastal waters, and near 22.235 GHz to measure precipitable water in the atmosphere. Recommendations to improve on these findings are presented. Author

N69-31082# Dominion Observatory, Ottawa (Ontario).
RESULTS OF REGIONAL UNDERWATER GRAVITY SURVEYS IN THE GULF OF ST. LAWRENCE
A. K. Goodacre, B. G. Brule, and R. V. Cooper 1969 27 p refs *Its* Gravity Map Ser. No. 86
Avail: CFSTI

The underwater gravity survey of the Gulf of St. Lawrence was continued in 1966 and 1967. Some 1,200 gravity stations have now been established in the Gulf during the period 1962–1967. Equipment and survey techniques used in the survey are described and the method of reduction of the underwater gravity results is reviewed. The Bouguer anomaly field over the norther portion of the Gulf of St. Lawrence is similar to that of the adjacent Precambrian Shield. A distinct change in anomaly level from negative in the north to more positive in the south occurs in the Gulf and is believed to mark the boundary between the Grenville and Appalachian geological provinces. Basic intrusive rocks characteristic of the boundary between these provinces are outlined by a belt of positive anomalies from Gaspé Peninsula to Port-au-Port Peninsula, Newfoundland. A gravity minimum of −60 mgal near Magdalen Islands has been attributed to abnormally light carboniferous sediments or Devonian granitic rocks or alternatively their combined effect. The gravity anomalies between southwestern Newfoundland and Cape Breton Island suggest a structural continuity between these areas. Author

N69-31136*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
LARGE TEMPORAL VARIATIONS OF ENERGETIC ELECTRON INTENSITIES AT MID-LATITUDES IN THE OUTER RADIATION ZONE Progress Report
D. M. Yeager and L. A. Frank Feb. 1969 40 p refs
(Grant NGL-16-001-002; Contract Nonr-1509(06))
(NASA-CR-103258; Rept-69-13) Avail: CFSTI CSCL 04A

A thorough search of Explorers 12 and 14 observations of electron (40 keV $\leq E \leq$ 2 MeV) intensities within the outer radiation zone during the period 1961–1963 has provided evidences of several catastrophic rapid decreases and recoveries of these electron intensities within periods ~ several minutes at L-values ~ 5 to 6. It is shown that typical values for these intensity fluctuations are by factors $\geq$ 500, $\geq$ 100 and $\geq$ 1000 for electrons E > 40 keV, 230 keV and 1.6 MeV, respectively. A comparison of the temporal variations of integral energy spectrums of electron intensities, latitudes of the observed events, ground-based observations of auroral magnetic activity, and low-altitude measurements of electron intensities within the above energy range allows this striking phenomenon to be interpreted in terms of redistribution of these outer zone electrons during the distortion of the geomagnetic field by the low-energy plasma producing the associated magnetic disturbance and of conservation of the first two adiabatic invariants μ and I. Author

N69-31177*# Stanford Univ., Calif. Remote Sensing Lab.
NEAREST NEIGHBOR: A NEW NON-PARAMETRIC TEST USED FOR CLASSIFYING SPECTRAL DATA
Paul Switzer, Wilbur E. Chapman, and James J. Nadeau 30 Dec. 1968 34 p refs
(Contract NAS9-7313)
(NASA-CR-101786; SU-RSL-TECH-68-3) Avail: CFSTI CSCL 09G

The nature of nonparametric statistical inference usually requires testing with large amounts of data to achieve a respectable degree of accuracy. It is felt that this program has a wide range of applicability and especially for data with categories of high dimensions. The flexibility which is given to the experimenter in changing and varying his constants and space matrix should aid him considerably, not only in finding the best testing conditions, but also in gaining an insight into the nature of the data itself that may never have come to his attention otherwise. Author

N69-31184# California Univ., Los Angeles. Dept. of Meteorology.
NUMERICAL SIMULATION OF THE GENERAL CIRCULATION OF THE ATMOSPHERE Interim Report
Akio Arakawa, Akira Katayama, and Yale Mintz [1969] 21 p refs Proc. of the WMO/IUGG Symp. on Numerical Weather Prediction, Tokyo, 1968 *Its* Reprint No. 4
(Grant NSF-GA-1470)
Avail: Issuing Activity

A numerical model of the atmosphere is developed and used to simulate the general circulation and global climate. The atmosphere between the earth's surface and 200 mb pressure is divided into two layers of equal mass. The time-dependent variables are the horizontal velocity and temperature of the two layers, the water vapor in the lower layer, and the surface pressure. The kinetic energy dissipation in the model is mainly by surface friction and friction at the interface between the layers. The heating by solar radiation depends on the water vapor and diagnostically determined clouds. There are two kinds of condensation in the model. One is large scale condensation, which occurs when the grid scale relative humidity exceeds its saturation value. The other kind is convective condensation. Evaporation from the surface depends on the difference between the vapor pressure of the air and the vapor pressure of the surface. Some results of a simulation of the general atmospheric circulation, made with the numberical model, are shown on global synoptic charts. Author

N69-31197*# Nevada Univ., Reno. Mackay School of Mines.
GROUND DATA INVESTIGATIONS, SONORA PASS, SITE 19, MISSION 78
Jack G. Ouade, Peter E. Chapman, and Peter A. Brennan Sep. 1968 26 p *Its* Tech. Letter No. 14
(Contract NAS9-7779)
(NASA-CR-101788) Avail: CFSTI CSCL 08G

The data were gathered during August of 1968, prior to and during flights 1 and 2 of mission 78, flown with the P3A, NASA 927 aircraft. These data were gathered in support of the infrared spectrometer experiment. Flight 1 on August 27, 1968, flew three high altitude and seven low altitude runs over Blackhawk Mountain. Three high altitude runs were made over Brown Bear Pass and two runs on the line between the two targets, a distance of 2-1/2 miles. Flight 2 of August 28th included a low altitude run over Blackhawk Mountain, seven low altitude runs over Brown Bear Pass, and a number of runs over the metamorphic rocks five miles south of Brown Bear Pass. Ground truth information was provided by two crews, stationed at Blackhawk Mountain and Brown Bear Pass. Author

N69-31188*# Nevada Univ., Reno. Mackay School of Mines.
JPL MICROWAVE EXPERIMENT SUPPORT
Peter A. Brennan, Peter E. Chapman, and Jack G. Quade Nov. 1968 88 p refs *Its* Tech. Letter No. 15
(Contract NAS9-7779)
(NASA-CR-101793) Avail: CFSTI CSCL 08M

Studied were the effects of various geologic parameters on microwave radiometer responses. Ground based radiometer data was generated by a 9.2 GHz portable microwave instrument operating at 1.4, 13.7, 37.0, and 94.0 GHz. Field experiments were conducted to determine the effects of look angle, grain size, soil moisture, and density, and to establish the depth of penetration of different microwave frequencies. A variety of materials were

observed at several different test nodes selected by the University of Nevada. The technical letter discusses the ground truth measurements made by the ground data team and the 9.2 GHz portable radiometer data. Included in the ground data are measurements made at test nodes. Author

N69-31200 Royal Greenwich Observatory, Herstmonceux (England).
TIME AND LATITUDE SERVICE 1967, JULY–SEPTEMBER
R. v. d. R. Woolley 1969 14 p *Its* Roy. Obs. Bull. No. 150
Copyright. Avail: HMSO 2s 6d

Greenwich time and latitude observations are tabulated for the period July–September 1967. Included are atomic time scale (G.A.) determinations derived from CsA and CsB mean values, as well as time and latitude observations made with a photographic zenith tube. Radio time signals and standard frequency emissions are also given. A.C.R.

N69-31201 Royal Greenwich Observatory, Herstmonceux (England).
TIME AND LATITUDE SERVICE 1967, APRIL–JUNE
R. v. d. R. Woolley 1969 14 p *Its* Roy. Obs. Bull. No. 149
Copyright. Avail: HMSO 2s 6d

Greenwich time and latitude observations are tabulated for the period April through June 1967. Included are atomic time scale determinations (G.A.) derived from the mean values of CsA and CsB at the Herstmonceux and Teddington locations, as well as time and latitude observations made with a photographic zenith tube at Herstmonceux. Radio time signals and standard frequency emissions are also given. A.C.R.

N69-31202 Royal Greenwich Observatory, Herstmonceux (England).
TIME AND LATITUDE SERVICE 1967, OCTOBER–DECEMBER
R. v. d. R. Woolley 1969 16 p *Its* Roy. Obs. Bull. No. 151
Copyright. Avail: HMSO 2s 6d

Greenwich time and latitude observations for the period October through December 1967 are tabulated. Included are atomic scale determinations (G.A.) derived from the mean values of CsA and CsB, as well as time and latitude observations made with photographic zenith tubes. Radio time signals and standard frequency emissions are also given. A.C.R.

N69-31226# Bureau of Commercial Fisheries, Miami, Fla. Tropical Atlantic Biological Lab.
OCEANIC CONDITIONS IN THE EASTERN CARIBBEAN SEA AND ADJACENT ATLANTIC, 6 AUGUST TO 6 OCTOBER 1965 (PART OF GERONIMO CRUISE 6)
Thomas D. Leming and Merton C. Ingham Washington Mar. 1969 35 p refs *Its* Contrib. No. 101
(PB-182948; FWS-DR-33) Avail: CFSTI CSCL 08J

The atlas comprises a series of horizontal, isopycnic, and vertical sections. The distributions of temperature, salinity, dissolved oxygen, and dissolved phosphate-phosphorus are shown on the 0-, 20-, 50-, 100-, 150-, 250-, and 400-m. horizontal surfaces, on the 25.5-g/l. isopycnic surface, and in two vertical sections across the central Caribbean. The topography of the 25.5-g/l. isopycnic surface is shown also. Author (USGRDR)

N69-31235# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
COLD REGIONS SCIENCE AND ENGINEERING MONOGRAPH 3, SECTION A2B: INVESTIGATION AND EXPLOITATION OF SNOWFIELD SITES
Malcolm Mellor Jan. 1969 66 p refs
(AD-686314; CRREL-CRSE-3-A2B) Avail: CFSTI CSCL 13/2

The document covers the site investigations and laboratory tests in connection with construction on a permanent snowfield and then deals with the technology of excavation and building where snow is almost the only constructional material. The author draws heavily on the work of the Cold Regions Research and Engineering Laboratory (CRREL) in the development of Camp Century and other projects on the Greenland ice sheet and shows the application of the techniques to Antarctic Research Stations. Author (TAB)

N69-31254# Geological Survey, Menlo Park, Calif. National Center for Earthquake Research.
PRELIMINARY INTERPRETATION OF AEROMAGNETIC AND GRAVITY DATA NEAR THE LARGE APERTURE SEISMIC ARRAY, MONTANA
Isidore Zietz, Carter Hearn, and Donald Plouff 1968 40 p refs
(ARPA Order 923)
(AD-674977) Avail: CFSTI CSCL 8/11

Aeromagnetic and gravity maps of part of eastern Montana indicate the existence of several distinct crustal units whose influence must be considered in the interpretation of seismic data recorded at the large aperture seismic array. The magnetic map suggests the area contains 5 major crustal units separated by fault-like boundaries. The principal features of the gravity map are a marked high over the porcupine dome, and a 40- by 70-mile gravity low to the northeast of porcupine dome. Author (TAB)

N69-31298# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
RING TENSILE STRENGTH STUDIES OF ICE
Guenther E. Frankenstein Feb. 1969 44 p refs
(AD-686284; CRREL-TR-172) Avail: CFSTI CSCL 8/12

The paper gives the results of ring tensile strength tests of lake and sea ice. The sea ice tested was normal, low-salinity, and high-salinity sea ice. Author (TAB)

N69-31322# Ohio Univ., Athens. Avionics Research Group.
EARTH COVER AND CONTOUR EFFECTS ON IMAGE GLIDE PATHS, PHASE 3 Final Report
Richard H. McFarland, James T. Gorman, Thomas Gilchrist, James Rice, Warren Wistendahl et al Sep. 1968 346 p refs
(Contract FA-67-WA-1676)
(RD-68-60; EER-5-7) Avail: Issuing Activity

Results of a theoretical and experimental investigation are presented which include evidence that the image glide path angle as seen by the monitor can move up or down and can exceed tolerances when snow covers the ground. Correlation between measured near and far-field path positions with snow is given together with calculations predicting effects of snow. Effects of irregular terrain on the glide path are also calculated and measured. The three-dimensional structures of the glide path are computed and measured. Calculations with accuracies on the order of 10% can be obtained for sites where terrain is reasonably uniform in the direction perpendicular to the runway centerline extended. A capability now exists for predicting characteristics of glide paths with hypothetical ground planes, specific earth fills, different percentages of grades, plantings of given botanical specimens, or man-made obstructions. The type of image antenna system needed for commissioning at a given site can also be determined. Findings concerning the use of radio telemetering theodolite, optimum phasing of the glide path, magnetic data-tape recording of path characteristics, and aircraft receiver filter characteristics are also discussed. Author

N69-31331# Dominion Observatory, Ottawa (Ontario).
RECORD OF OBSERVATIONS AT MEANOOK MAGNETIC OBSERVATORY, 1947–1948
H. E. Cook, Anne B. Cook, and R. G. Madill 1969 107 p *Its* Publ. Vol. 83, No. 2
Avail: CFSTI

The observatory is part of a world network supplying disturbance data for composite K-indices; it has a disturbance field closely related to the auroral zone situated about 350 miles in a northeasterly direction. This volume briefly describes the instruments at the observatory, the magnetic reductions, the magnetic activities and ratios, the mean values for months and years, and the mean annual values for the period 1917 to 1948. The tabulated data for 1947 and 1948 make up the major part of this volume and cover: (1) mean hourly values of horizontal intensity, declination, and vertical intensity, hourly, daily, and monthly means, daily extremes, and range with monthly means; and (2) diurnal inequalities of H, D, and Z, monthly, annual, and seasonal values for all days and international quiet and disturbed days. K.W.

N69-31449# Ionospharen-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBURG, URSI-CODE 131, APRIL 1969 [IONOSPHAEREN-DATEN, VERTIKAL-ECHO-LOTUNG: FREIBURG, URSI-CODE 131, APRIL 1969]
Apr. 1969 44 p In GERMAN and ENGLISH
(Rept-274-F) Avail: CFSTI

Ionospheric data for April 1969, Freiburg, Germany are tabulated. Author

N69-31492# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PRELIMINARY LONG-PERIOD DISCRIMINATION RESULTS FROM NORSAR
Ronald W. Ward Feb. 1969 34 p refs
(Contract AF 19(628)-5167; ARPA Order-512)
(AD-686419; TN-1969-10; ESD-TR-69-9) Avail: CFSTI CSCL 17/10

Data from the short-period vertical subarray near Oyer and the multicomponent long-period seismograph near Faldalen, Oyer and Trysil, Norway, were used to investigate the discrimination of earthquakes and underground nuclear detonations using long-period to short-period energy ratio (M sub s vs m sub b). Author (TAB)

N69-31497# Utah State Univ., Logan. Electro-Dynamics Labs.
NIGHT AIRGLOW OI GREEN, CONTINUUM, AND HYDROXYL EMISSIONS
Ray O. Waddoups and Doran J. Baker 1 Jun. 1968 109 p refs
(Contract AF 9(628)-5916)
(AD-686113; SR-5; AFCRL-68-0330) Avail: CFSTI CSCL 4/1

Three rocketborne measurements of night airglow emissions are reported. Maximum OI-green emission of 14 R/km was observed at 102 km. Maximum continuum emission of 0.04/RA/km was observed at 91 km, and maximum OH (8,3) emission of 44 R/km was observed at 97 km. Simultaneous measurement of high-energy electron flux and OI-green emission showed that no significant amount of excitation resulted from high-energy electron bombardment. These emission measurements, together with similar measurements reported by other investigators, were analyzed to determine the excitation mechanisms responsible for the emissions. Author (TAB)

N69-31499# Utah Univ., Salt Lake City. Upper Air Research Labs.
SATELLITE PLASMA FREQUENCY PROBE FOR HIGH SPATIAL RESOLUTION ELECTRON DENSITY MEASUREMENT Interim Report
Earl F. Pound and David A. Burt Dec. 1968 68 p refs
(Contract AF 19(628)-4995)
(AD-686114; UU-68-11; SR-11; AFCRL-68-0672) Avail: CFSTI CSCL 4/1

The report presents details of the instrumentation for a satellite experiment called a plasma frequency probe designed to provide high resolution measurements of electron density for investigation of F-region irregularities. The plasma frequency probe technique involved determination of electron density and electron temperature by measuring the resonance frequencies of an antenna immersed in the plasma. A low level RF voltage, swept from 19 to 0.1 MHz, is applied to a short whip antenna, and the resonances are determined by the use of a broadband phase detector. The resonance frequencies are measured eight times per second (approximately every kilometer), coded for PCM telemetry, and recorded on a 10-hour storage capacity tape recorder. With a playback-to-record speed ratio of 80 to 1, ten hours of recorded data can be replayed on a single satellite pass. The units described were flown on polar-orbiting satellites OV3-5 and OV3-6. Author (TAB)

N69-31516# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
REPORT: RESEARCH AND OPERATIONS, JULY 1967-JUNE 1968
Jun. 1968 38 p refs
(AD-686298) Avail: CFSTI CSCL 4/1

Contents: Atmospheric sciences office; Meteorological rocket network; Physics of the atmosphere; Artificial cloud nucleation; Atmospheric attenuation; Meteorological research; Meteorological support. TAB

N69-31538# Manila Observatory (Philippines).
H-ALPHA PLAGE CONFIGURATION AS A PREDICTOR OF LARGE FLARES Final Report, 1 Jun.–31 Dec. 1968
Richard A. Miller and Allan V. Trinidad 31 Jan. 1969 20 p refs
(Contract F19628-68-C-0255)
(AD-686169; AFCRL-69-0112) Avail: CFSTI CSCL 3/2

Pre and post flare H-alpha plage configurations for 132 major flares over a period of more than two years were examined. The records of H-alpha plage configurations at the Manila Observatory showed a predisposing visual indication of major flare activity was a gradual folding and sharpening of plage streamers into a roughly gamma or lambda shape. Major flares occurred within the accuracy of position measurements at the junction of these bright streamers. When these configurations softened into rounded shapes, the likelihood of a major flare in these areas for the interval studied, dwindled to zero. Author (TAB)

N69-31558# Air Force Cambridge Research Labs., Bedford, Mass. Aerospace Instrumentation Lab.
DISTRIBUTION OF ROBIN SENSED WIND SHEARS AT 30 TO 70 KILOMETERS
Henry A. Salmela and Norman Sissenwine Washington Office of Aerospace Res. Feb. 1969 18 p refs
(AD-686110; ERP-298; AFCRL-69-0053) Avail: CFSTI CSCL 4/1

Distributions of wind shear for several layer thicknesses were computed for six stations from a selected sample of ROBIN

sensor meteorological rocket soundings. Wind shears in the 30- to 70-km layer are generally weak but very strong shears were occasionally observed. Strongest shears occur at highest altitudes, 60 to 70 km, over latitude stations during the seasons of reversal in zonal flow. There is also evidence that wind shears decrease in strength with increasing latitude. Author (TAB)

N69-31628*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

INVESTIGATION OF THE EARTH'S GRAVITATIONAL EFFECTS ON THE MOTION OF NEAR EARTH SATELLITES

S. M. Yionoulis Jun. 1969 180 p refs Sponsored by NASA (Contract NOw-62-0604-c)

(NASA-CR-103303; TG-1069) Avail: CFSTI CSCL 22A

The accuracy with which the earth's gravitational field can be defined from an analysis of satellite data is strongly dependent upon the satellite constellation used. The constellation selected must satisfy several criteria. The objective of this study was to produce quantitative information on the effects of the geopotential harmonics on the motion of satellites for a large variety of orbits. These data can then be used to investigate satellite constellations which will yield useful geodetic information. Author

N69-31636# Minnesota Univ., Minneapolis. School of Mineral and Metallurgical Engineering.

A COMPARATIVE FIELD STUDY OF ROCK STRESS DETERMINATION TECHNIQUES

Francois Bonnechere Apr. 1969 65 p refs (Contract DACA45-67-C-0088)

(AD-686307; TR-1-69) Avail: CFSTI CSCL 8/7

Numerous different techniques have been developed for the determination of in-situ stresses in rocks. Generally, each system has been designed and calibrated or tested independently of the others. The purpose of this research was to make a comparative study of several different techniques under the same carefully controlled field conditions. A four foot square on a quarry floor was first instrumented and then relieved from any regional stresses by drilling four slots (4 ft. 6 in. long and 9 ft. deep) at right angles around the instrumented region. The piece of rock isolated by this way was then restressed by means of flat jacks inserted in the slots. With this arrangement it was possible to compare the various techniques of rock stress determination in either uniaxial or biaxial stressfields generated by pressurizing the opposite pairs of flat jacks. Results strongly suggest that data obtained from current techniques of stress determination cannot be relied upon within plus or minus 20% to 30% of the mean values, even under carefully controlled conditions. Author (TAB)

N69-31638*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Metallurgy.

INHOMOGENEITIES AND IRON DIFFUSION IN A THAILAND TEKTITE Semiannual Report, Apr. 1969

A. K. Varshneya and A. R. Cooper 9 Jul. 1969 18 p refs Presented at the 3d Intern. Tektite Symp., Corning, N.Y., 1969 (Grant NGR-36-003-100)

(NASA-CR-103304) Avail: CFSTI CSCL 08G

Sections of a Thailand tektite were examined under an electron microprobe for composition fluctuations. A comparison is made with similar data from a laboratory synthesized tektite of duplicate composition. To estimate the kinetics of the diffusive mixing of local composition fluctuations, effective binary diffusion coefficients were measured at various temperatures above 1000°C. Data for Fe, in particular, is used to calculate the homogenization times of a hypothetical tektite source with a periodic variation of iron. This in turn is used to suggest limits for the thermal history of tektite glasses. Author

N69-31646# Westinghouse Research Labs., Pittsburgh, Pa.

BALL LIGHTING Final Report

Martin A. Uman 1 Apr. 1969 11 p refs (Contract F44620-68-C-0073)

(AD-686094; AFOSR-69-0782TR) Avail: CFSTI CSCL 4/1

A brief description of the characteristics of ball lightning is given. The results of calculations of the decay with time of the visible light output, the weight, and the temperature of heated spheres of (1) air, (2) air with trace amounts of sodium, (3) air-carbon mixtures, and (4) air-copper mixtures are discussed. Spheres of ball lightning size initially at 10,000K for the first two cases maintain a total output of visible radiation that is greater than that of a 40 W light bulb for more than 10 seconds; however, the spheres rise due to buoyancy and decay in brightness by more than a factor of 2 every 2 seconds. The latter two mixtures at a few thousand degrees Kelvin and atmospheric pressure can have the same mass density as air at STP and hence will not rise, but their visible light output is not that reported for natural ball lightning. Author (TAB)

N69-31665# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.

TURBULENT CHARACTERISTICS IN THE SURFACE BOUNDARY LAYER

Manuel Armendariz, Laurence J. Rider, and Frank V. Hansen Nov. 1968 26 p refs

(AD-685852; ECOM-5225) Avail: CFSTI CSCL 4/1

The turbulent characteristics of the first 62 meters of the atmosphere over White Sands Missile Range, New Mexico, have been intensively studied using data collected from an instrumented tower. It is demonstrated that important turbulence characteristics such as standard deviation of wind direction, longitudinal intensity of turbulence, and the ratio of the lateral intensity of turbulence to longitudinal intensity of turbulence are dependent upon the height of the wind measurement, the surface roughness, and the stability of the atmosphere. In particular, it is shown that the lateral intensity of turbulence is affected more by stability changes than by roughness or height of the measurement. The longitudinal intensity of turbulence, however, is affected by roughness and height of measurement as well as by the stability of the atmosphere. Author (TAB)

N69-31682# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

SOLAR CONTROL OF THE STRATOSPHERIC CIRCULATION

Willis L. Webb Feb. 1969 18 p refs

(AD-685853; ECOM-5234) Avail: CFSTI CSCL 4/1

A gross monsoonal character exhibited by the stratospheric circulations annual variation indicates a close general relationship with solar heat input. Synoptic exploration of this 25-80 km region by the Meteorological Rocket Network has divulged two major processes as a result of which solar control is markedly modified. These are the semiannual dynamic winter storm periods and the nongeostrophic thermal tidal circulations. The degree to which solar control is lost is illustrated by the stratospheric circulation data. The impact of these dynamic stratospheric circulation events on the structure of the exosphere is discussed, and the interaction of the exosphere with the solar wind is considered. Author (TAB)

N69-31715# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

THERMAL INSTABILITY IN A LAYER OF WATER FORMED BY MELTING ICE FROM BELOW

Yin-Chao Yen Mar. 1969 20 p refs

(AD-686283; CRREL-RR-263) Avail: CFSTI CSCL 8/12

The transition in the mode of heat transfer from conduction to convection in a layer of water formed continuously by melting ice from below has been determined experimentally. This was accomplished by locating the inflection point on the curve relating the water-ice interface (or melting front) and time. Thus, the critical Rayleigh number, Rac, at which convective heat transfer started can be correlated empirically as a function of warm plate temperature. Homogeneous, bubble-free ice was prepared and used in all the experiments. Author (TAB)

N69-31728# Coast and Geodetic Survey, Rockville, Md.
US COAST AND GEODETIC SURVEY, SEISMOGRAPH SYSTEMS
Richard Navarro and Kenneth W. King Jun. 1967 143 p refs
(CGS-C-106) Avail: CFSTI

The Special Projects Party of the Coast and Geodetic Survey has used many types of seismograph systems in its participation in nuclear and high explosive tests since 1949, both on and off-site of the Nevada Test Site. This participation has included ground motion measurements, vibration studies, and background and earthquake monitoring. All the seismograph systems presently utilized by Coast Survey in accomplishing its objectives to the Nevada Operations Office of the Atomic Energy Commission and other users in the nuclear and high explosive testing program are described. Also, the procedure used to calibrate each system is described. Author (NSA)

N69-31754# Stanford Univ., Calif. Electronics Labs.
SPECTRUM ANALYSIS OF VLF EMISSIONS
Byung Gan Lee Aug. 1968 51 p refs
(Grant AFOSR-0783-67A)
(AD-686068; SU-SEL-68-081; AFOSR-68-2344; TR-3412-10) Avail: CFSTI CSCL 4/1

Amplitude analysis of discrete VLF emissions using the Rayspan spectrum analyzer showed characteristics that are not readily detected using the conventional frequency spectrograms. From a small sampling of discrete VLF emissions recorded at various ground stations, the following observations were made: Rise and fall times may be as small as 15 - 20 msec; Emissions that appear single on a frequency spectrogram may consist of closely-linked shorter emissions, each having a duration of the order of 100 msec; Frequency modulation, previously suspected in some frequency spectrograms, is confirmed. In the samples studied the frequency of modulation ranged from 35 Hz to 70 Hz, while the frequency deviation lay mainly in the range 25 Hz to 50 Hz. Author (TAB)

N69-31756# Naval Research Lab., Washington, D.C.
UPPER-ATMOSPHERE-DENSITY DETERMINATION USING NRL ARTIFICIAL SATELLITES
R. Brescia Mar. 1969 11 p refs
(AD-686068; NRL-6850) Avail: CFSTI CSCL 4/1

NRL has had several artificial satellites placed in orbit for various experimental purposes. By observing the changes in orbital elements, it has been possible to calculate the density at the altitude range of 950 to 1160 km for the past 3 years. Long- and short-term effects are noted and discussed. A cyclical variation of 27 days has been found. It is apparently due to the variation in solar activity with the suns rotation. The centers of activity appear to be stationary on the suns surface for months at a time. Author (TAB)

N69-31760# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
LABORATORY DETERMINATION OF DYNAMIC MODULI OF FROZEN SOILS AND OF ICE
Chester W. Kapler Jan. 1969 55 p refs
(AD-686282; CRREL-RR-163) Avail: CFSTI CSCL 8/12

The report presents a summary of results of laboratory investigations of frozen soils and ice to determine the elastic moduli by the dynamic (sonic) method. The elastic moduli were indirectly obtained by measuring the fundamental resonant frequencies of flexural, longitudinal, and torsional vibrations induced in prismatic beams by electromagnetic means. Vibration tests were performed on a total of 58 specimens representing 12 different materials (8 natural soil types, ranging from coarse-grained to fine-grained; 2 blended soils; a natural peat; laboratory-frozen ice and natural lake ice, at temperatures ranging from approximately +32F to -10F). Elastic wave velocities (longitudinal and torsional) were computed for each material in the range of test temperatures studied. All soils were saturated or were close to saturation. Author (TAB)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N69-30506*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF TWO MODELS OF COMMERCIAL UNBONDED STRAIN-GAGE-TYPE ABSOLUTE PRESSURE TRANSDUCER AT 260 DEG C
Ralph D. Lewis Washington Jul. 1969 23 p ref
(NASA-TN-D-5327) Avail: CFSTI CSCL 14B

Four transducers of each model were tested. Probable error for the sample transducers was 1 percent of span if each transducer was calibrated at 260°C and zero shifts were corrected for. Zeros shifted with time, storage at room temperature after initial testing for 650 hours at 260°C, and temperature cycling. Maximum rate of zero shift was about 0.01 percent of span per hour. Rate of zero shift usually decreased with time at 260°C. Mean sensitivity change in 650 hours at 260°C was 0.07 percent of initial value. Mean nonlinearity at 260°C was 40 and 0.51 percent of span, respectively, for the two models. Mean hysteresis at 260°C was 0.55 and 0.11 percent of span. Author

N69-30534*# Scripta Technica, Inc., Washington, D.C.
THE COCK-TYPE INDICATOR AS AN INSTRUMENT FOR DETECTING ADMIXTURES IN SODIUM
F. A. Kozlov et al. *In its* Liquid Metals May 1969 p 324–335 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 14B

The special indicator for detecting admixtures in liquid metals is described. The operation, construction, calibration and other aspects of the instrument are given in great detail. Experimental data obtained with the instrument by different investigators are plotted and compared. Author

N69-30544*# Scripta Technica, Inc., Washington, D.C.
FLOWMETER FOR MEASURING LARGE LIQUID-METAL FLOWS
N. L. Loginov *In its* Liquid Metals May 1969 p 403–405 (See N69-30507 17-33)
Avail: CFSTI CSCL 14B

The device described is a flowmeter which operates by measuring the velocity at one point in the flow. The size of the

instrument is moderate in comparison with the size of the pipeline. It is intended for operation at 50-1000 m^3/hour of a liquid metal flowing in a pipeline 300 mm in diameter. Other operating parameters are also given. Author

N69-30578*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

SCIENCE SCREENING REPORT OF THE APOLLO 7 MISSION 70-MILLIMETER PHOTOGRAPHY AND NASA EARTH RESOURCES AIRCRAFT MISSION 981 PHOTOGRAPHY

John L. Kaltenbach comp. Jun. 1969 179 p refs
(NASA-TM-X-58029) Avail: CFSTI CSCL 14E

Scientists representing disciplines related to earth resources present preliminary interpretations of the 70-millimeter photography taken by the crew of the Apollo 7 spacecraft. The photographs are compared with photographs taken at conventional aircraft altitudes and are evaluated regarding applications. The individual photographic frames were examined with reference to important interpretation parameters. Uses and benefits in the areas of land use planning, cartographic production, weather forecasting, oceanographic studies, regional geology, hydrological analyses, and agricultural surveys are described. Author

N69-30648# Institut fuer Angewandte Geodaesie, Frankfurt Am Main (West Germany).

ELECTRICAL MEASUREMENT OF GRAVITY DIFFERENCES WITH A LA COSTE-ROMBERG GRAVIMETER [ELEKTRISCHE MESSUNG VON SCHWEREDIFFERENZEN MIT EINEM LA-COSTE-GRAVIMETER]

Rudolf Brein 1967 16 p refs In GERMAN; ENGLISH summary *Its* Pamphlet No. 141
(Rept-93) Avail: CFSTI

In order to record temporal variations of gravity for the study of earth tides, a device was incorporated into the gravimeter which permits the compensation of gravity differences by electrical means. Thus, the customary elastomechanical function of the gravimeter is eliminated to a large extent in the measurement of gravity differences. The device is described, and test results obtained in recording and measuring gravity differences in the field are presented. Author

N69-30689*# Geological Survey, Washington, D.C.

AN AIRBORNE MULTISPECTRAL TELEVISION SYSTEM

C. J. Robinove and H. E. Skibitzke 1967 4 p Prepared in cooperation with NASA
(NASA-CR-101752) Avail: CFSTI CSCL 14E

Airborne multispectral television images were obtained in the visible and near infrared ($<2.2\mu$) region of the spectrum and recorded on videotape in a light aircraft. The images are of lower spatial resolution than aerial photographs from equivalent altitude but have the advantage of allowing quite narrow bandpass filtering and instant reproduction of the images for use by interpreters. Such imagery may be quite useful for fast coverage of dynamic events, where aerial data are needed quickly but not to the photogrammetric precision of aerial photographs. The use of airborne television imagery by field scientists will prepare them to use similar but smaller scale data from earth orbiting satellites. Author

N69-30780# Atomic Energy Commission Research Establishment, Riso (Denmark).

PORTABLE BERYLLIUM PROSPECTING INSTRUMENT WITH LARGE SENSITIVE AREA

L. Lovborg, H. Kunzendorf, and J. Hansen (Copenhagen Univ.) *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 55-83 refs (see N69-30776 17-13)
(SM-112/4) Avail: CFSTI

The instrument described was designed on the basis of the photoneutron method of determining beryllium in rock surfaces and developed with a view to prospecting beryllium in the Ilimaussaq intrustion, South Greenland. These minerals occur mainly in hydrothermal veins which are from 1 mm to about 2 m wide. The distinctive feature of the prospecting instrument is a comparatively large effective measuring area (≈ 500 cm^2). The instrument consists of a detector unit and a control unit. The detector unit has the dimensions 46 × 21 × 10 cm, weighs 20 kg, and contains a 30-cm long gamma-activation device, biological radiation shield, and two 30-cm long He^3-filled neutron proportional detectors embedded in paraffin wax. The gamma activation device consists of 31 identical Sb^{124}-sources placed in a steel tube with spacings decreasing towards the ends of the tube and with a total activity of 20 mCi. The total sensitivity of the instrument is about 35 counts/min per % BeO per mCi Sb^{124}, and the background count rate is 12-20 counts/min. The corresponding theoretical detection limit for a single measurement of 8-min duration is 35-50 ppm BeO. Author

N69-30781# Atomic Energy Commission Research Establishment, Riso (Denmark).

USE OF THEORETICAL MODELS FOR NEUTRON MOISTURE GAUGE CALIBRATION AND DESIGN

P. L. Olgaard *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 65-79 refs (See N69-30776 17-13)
(SM-112/1) Avail: CFSTI

The response of these gauges is affected by the moisture content, the chemical composition, and density of the dry media. To perform accurate measurements the effect of the density and composition of the dry media must be taken into account. This can be done by use of the theoretical models which were developed for the gages, in particular for sub-surface probes. The basic physics behind the neutron moisture gages is outlined, and the various existing theoretical models are reviewed. The effect of variation in dry soil density is discussed, and it is emphasized that it is not possible to perform good measurements by use of just one calibrating curve corresponding to one dry soil density. Theoretical models allow the determination of calibrating curves for various dry soil densities, provided the soil composition is known. A theoretical method is discussed by use of which it is possible to obtain calibration curves corresponding to any dry medium density without detailed knowledge of the composition of the medium. This method demands that a set of calibration measurements exists for the probe and soil under consideration. A short discussion of theoretical models for surface moisture gages is also given, and the need for a simple, yet reliable model for surface gages is stressed. Author

N69-30787# Geological Survey of Canada, Ottawa (Ontario).

AIRBORNE GAMMA-RAY SPECTROMETER EXPERIMENTS OVER THE CANADIAN SHIELD

A. G. Darnley, G. Bristow, (Atomic Energy of Canada, Ltd., Ottawa) and D. K. Donhoffer (Atomic Energy of Canada, Ltd., Ottawa) *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 163-186 refs (See N69-30776 17-13)
(SM-112/11) Avail: CFSTI

A high sensitivity spectrometer for radiometric mapping of the Canadian Shield was produced. Ground control was provided by measurements with field gamma ray spectrometers on a 200-ft grid over 3 square miles. An experimental spectrometer employed three 5 × 5 in. (12.5 × 12.5 cm) diam. NaI (Tl) detectors, in order to record the full gamma-spectrum in real-time on magnetic tape. To provide the highest possible count rates per unit distance at varying heights the spectrometer was flown in a helicopter at 25 mph (40 kmph). A study of the spectra obtained shows that the optimum spectral window widths for measuring the relative

abundance of potasium, uranium, and thorium are: potassium, ^{40}K 1.35 – 1.58 meV; uranium, ^{214}Bi 1.65 – 1.88 meV; thorium, ^{208}Tl 2.42 – 2.62 meV. The recorded data were processed through a PDP-9 computer to provide corrections for dead-time, Compton scattering, and deviations from constant terrain clearance. Based on this work a much more sensitive airborne system was constructed in 1968 and installed in a twin-engined STOL aircraft. The system employs twelve 9 × 4 in. (23 × 10 cm) NaI (Tl) crystals. This detector volume provides a 10% precision in corrected accumulated count in any of the three spectral windows when the aircraft measures radiation over an elapsed distance of 350 ft at a ground speed of 120 mph and 400 ft terrain clearance. The airborne system includes Doppler navigation, radar altimeter, and TV tracking camera equipment. Author

N69-30795# Tyco Labs., Inc., Claremont, Calif. General Nucleonics Div.

A VERSATILE FIELD INSTRUMENT FOR X-RAY FLUORESCENCE ANALYSIS

K. E. Duftschmid *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 325–342 refs (See N69-30776 17-13)

(SM-112/21) Avail: CFSTI

A portable X-ray fluorescence analyzer has been developed consisting essentially of an Xe/CH_4 proportional counter probe and an electronic unit with single channel analyzer, binary scaler, digital-to-analog converter with meter readout and an automatic gain control circuitry. The instrument utilizes the high energy resolution of proportional counters combined with the excellent long-term stability provided by automatic gain control (AGC). The radioactive source, ^{241}Am, is suitable for the excitation of fluorescence X-rays in a wide range of elements, i.e. from Cr-K (Z = 24) to Tm-K (Z = 69) and from Ba-L (Z = 56) to U-L (Z = 92). The same source is simultaneously used for the AGC operation by measuring a small fraction of the ^{241}Am gamma radiation (59.6 keV) directly incident through a small collimator hole into the detector. The count-rate measured above a threshold at 57 keV, which is not affected by any other fluorescent or scattered radiation, is used to control the detector high voltage in order to obtain a constant energy calibration and to eliminate any drift of the detector and the electronics. Thus several fixed single channel windows selected by a rotary switch can be set for various elements of interest. Once having been set in the laboratory no further calibration is necessary for field operation. The design features of the instrument make it extremely suitable for a wide range of prospecting and mining applications. Author

N69-30797# Texas Nuclear Corp., Austin.

A RADIOISOTOPE X-RAY FLUORESCENCE DRILL HOLE PROBE

J. R. Rhodes, T. Furuta, and P. F. Berry *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 353–363 refs (See N69-30776 17-13)

(SM-112/23) Avail: CFSTI

A radioisotope X-ray fluorescence drill hole probe of prototype design is described. The main potential application of such an instrument is for logging uncased and preferably dry drill holes in metalliferous ore deposits, for example, to locate cut-off horizons during development mining operations. A double scintillation detector arrangement is used, with balanced filters. The geometry of the source-detector assembly pays high regard to the importance of cylindrical symmetry and utilizes a simple design and inexpensive components. Initial results have been obtained for silver and uranium in concrete standards. Preliminary field tests on a model uranium hole are also described. Sensitivities of 0.015 wt. % Ag and 0.15 wt. % U in 10 s measurement times were obtained, and further improvements by at least a factor of two are shown to be possible. Author

N69-30820*# Norton Research Corp., Cambridge, Mass.

PROGRAM TO PRODUCE A FLIGHT PROTOTYPE COLD CATHODE QUADRUPOLE MASS SPECTROMETER

J. R. Roehrig [1969] 32 p

(Contract NAS1-5347)

(NASA-CR-66793) Avail: CFSTI CSCL 14B

A complete cold cathode quadrupole mass spectrometer system has been constructed as a flight prototype. The spectrometer and electronics are packaged as a single unit and weigh four pounds 13 oz. The system operates from a 28 volts dc source at an average power of 5.25 watts with a mass range of 1 – 50 amu and a resolution of 1 amu in the pressure range of 10^{-9} to 10^{-4} Torr. The mass range may be scanned in five seconds or slower as required. Possible future improvements are also discussed. Author

N69-30885# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.

FLUID VELOCITY MEASUREMENT BY DOPPLER SHIFT OF SCATTERED LIGHT Progress Report

William B. Clarke Oct. 1968 37 p refs

(Contract Nonr-3963(10))

(AD-68421) Avail: CFSTI CSCL 14/2

The report describes the laser Doppler velocimeter, and the design necessary to study turbulent flow of liquids where the spatial resolution required is 10 to 50 micrometers. For the lower limit it is necessary to use diffraction limited optics, to match the refractive indices of the pipe and the liquid, and for the beams to enter and leave the pipe normally. For a glass pipe containing water, 60 micrometers is the best resolution obtainable. Much higher powered lasers are needed if dissolved polymer is the scatterer, than if particles are used. Errors occur due to the velocity gradient in the scattering element, and to the finite included angles of the incident and scattered beams. Author (TAB)

N69-30983*# Arizona Univ., Tucson.

THIRTEEN-COLOR NARROW-BAND PHOTOMETRY OF ONE THOUSAND BRIGHT STARS

Richard I. Mitchell, Harold L. Johnson, (Univ. Nacl. Autonoma de Mex.) and G. P. Kuiper, ed. 24 Feb. 1969 52 p refs *Its* Paper No. 132 from Commun. of the Lunar and Planetary Lab., Vol. 8, Pt. 1

(Contract NSR-03-002-048; GRANT NSF GP-7827X)

(NASA-CR-103255) Avail: CFSTI CSCL 14E

Previously published eight-color photometry, obtained with a RCA 1P21, is combined with new red-infrared photometry obtained with a RCA 7102. The final system of 13 colors provides two sample points in the continuum above the Balmer discontinuity and two points below; similarly it gives four sample points above the Paschen discontinuity. The wavelength range of the photometry extends from 0.33 to 1.10 μ. An absolute energy calibration for the 13-color photometry has been derived. Author

N69-31028# General Electric Co., Philadelphia, Pa. Missile and Space Div.

RESEARCH ON AVALANCHE TYPE SEMICONDUCTOR RADIATION DETECTORS Semiannual Report, Jul.–Dec. 1968

Gerald C. Huth and Robert J. Locker Jan. 1969 61 p refs

(Contract AT(30-1)-3248)

(NYO-3246-TA-4) Avail: CFSTI

Gain uniformity in avalanche-type semiconductor detectors was investigated. The development of avalanche detector instrument

instrumentation, both battery and line operated, was discussed. The efficiency of avalanche detectors for electron detection in the 5 to 40 keV range was examined. NSA

N69-31053# European Atomic Energy Community, Geel (Belgium). Joint Nuclear Research Center.
SPECTRAL PERFORMANCE OF A Ge(Li) PULSE HEIGHT SPECTROMETER AT HIGH EVENT RATES
H. Meyer and H. Verelst Brussels 1969 12 p refs
(EUR-4240.e) Avail: CFSTI

For γ-ray spectroscopy with Ge(Li) detectors high event rates are often desirable, not only for their application in coincidence experiments but also because of the presence of large Compton background. Modern instrumentation techniques were applied and a fast servostabilized pulse height converter[14] has been used for the measurement of γ-ray spectra up to event rates of 300 kHz. The features of the spectrometer are described and performance limitations are discussed. Limitations are introduced especially by the detectors, if high peak-rate-to-peak-width ratios are desired. Author

N69-31057*# Nevada Univ., Reno. Mackay School of Mines.
ALBEDO MEASUREMENTS AT THE MT. LASSEN TEST SITE
Peter A. Brennan Dec. 1968 17 p refs *Its* Tech. Letter No. 16
(Contract NAS9-7779)
(NASA-CR-101794) Avail: CFSTI CSCL 14B

Albedo is a measure of the reflectivity of a material. The term is used for the decimal fraction of the incident light in the visible and near-infrared portion of the spectrum that is reflected by a surface. The albedo of a material directly or indirectly influences the response of instruments measuring energy fluxes in the visible infrared and microwave, and is thus a very important "ground truth" parameter. A large portion of the incoming solar energy is concentrated in the visible and near-infrared portion of the spectrum. The incoming radiation is either reflected or absorbed. The reflected energy is directly correlative with the photographic quality of the terrain. The absorbed energy influences the temperature of the material, but the correlation is affected by thermal parameters of the material and is, therefore, an indirect relationship. . . . Author

N69-31068# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INCLUSION OF TENSOR-SENSITIVE LATTICE OF AN ATTACHED SENSOR DURING THE DEFORMATION OF AN ELEMENT UNDER INVESTIGATION
A. I. Makeev 16 Dec. 1968 13 p refs Transl. into ENGLISH from Samoletostroyenye i Tekh. Vozdushnogo Flota (USSR), no. 8, 1966 p 114–120
(AD-686232; FTD-HT-23-659-68) Avail: CFSTI CSCL 14/2

The author attempts to evaluate the effect of rigidity of base, grid, cement, and tested element on the operating characteristics of the sensitive elements of strain gages. The stresses in the cement base of the sensor are greatest at the ends of the strain-sensitive grid, therefore the turns of the grid of loop strain-gage sensors must be carefully cemented to the base of the sensor. When the base of the sensor is enlarged its sensitivity coefficient also rises. A change in the modulus of rigidity of the cement under the effect of temperature, moisture, degree of deformation, and other factors leads to a change in sensor sensitivity. The sensitivity of the strain-gage sensor depends on the material of the part undergoing tests. Residual stresses in the cement occurring after hardening have an unfavorable effect on the work of the strain-gage sensor since they may change in time. It is advisable to subject the cemented strain-gage sensor to additional heat treatment or to cyclical deformation to reduce the residual stresses in the cement. The sensitivity coefficient of the strain-gage sensor increases with decreasing cement layer thickness and rising shear modulus in the cement. The distance from the end of the grid to the end of the strain-gage base must be selected in relationship to the rigidity properties of the cement, base material, and wire material. Author (TAB)

N69-31084# Comitato Nazionale per l Energia Nucleare, Rome (Italy).
RELIEF PROFILE OF THE ELECTRON TEMPERATURE AND THE ION DENSITY IN A CESIUM PLASMA DIODE BY SPECTROGRAPHIC MEASUREMENT [RILIEVO DI PROFILI DELLE TEMPERATURE ELETTRONICHE E DELLE DENSITA IONICHE IN UN DIODO A PLASMA DI CESIO PER MEZZO DI MISURE SPETTROGRAFICHE]
C. Rosatelli [1969] 36 p refs In ITALIAN; ENGLISH summary
(RT/FI(69)12) Avail: CFSTI

An experiment is reported for the determination of the electronic temperatures and ionic densities distribution in the inter-electrode gap of a cesium plasma thermoionic converter by means of spectrographic measurements. After a survey on the problems still open in studying the transport phenomena of the plasma, the measure techniques used are resumed; the equipment is described and the first results are shown. Author

N69-31102# European Atomic Energy Community, Ispra (Italy).
USE AND STUDY OF STRAIN-GAUGES ATTACHED BY THE "ROKIDE" PROCESS [MISE EN OEUVRE ET ETUDE DES JAUGES D'EXTENSOMETRIE FIXEES PAR LE PROCEDE "ROKIDE"]
R. Antoine Brussels Apr. 1969 103 p refs In FRENCH; ENGLISH summary
(EUR-4214.f) Avail: CFSTI

The aim of this study was to choose the best way of using high temperature strain-gauges attached by the Rokide process (flame spraying of alumina). The electrical properties up to 600°C of every type of alumina available in rods were compared in order to select the proper type. The apparent strain and gauge factor of four types of gauges were then determined as a function of temperature. Author

N69-31129# Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Radiophysics Lab.
RADIOPHYSICS LABORATORY Progress Report, 1965–1968
1968 28 p
(NP-17806) Avail: AEC Depository Libraries

Short summaries of the research progress are given for the programs on the performance of the 210-foot radiotelescope, the 210-foot–60-foot interferometer, receiver developments, mapping the sky for radio sources, interplanetary scintillations, galactic magnetic fields, OH in interstellar space, hydrogen recombination lines, the Large Cloud of Magellan, hydrogen in distant galaxies, pulsed radio sources, solar radio emission, cloud physics, convection and convective cloud, sampling ice nuclei, counters for natural ice nuclei, activation of ice nuclei, and rainmaking. NSA

N69-31141# Japan Broadcasting Corp., Tokyo. Technical Research Labs.
IMPROVEMENT OF 16mm EE CAMERA WITH MAGNETIC SOUND RECORDING

Hidehiko Kasama and Kinya Ishizaka Mar. 1969 13 p refs /ts Serial No. 127
Avail: CFSTI

A 16 mm EE camera with magnetic sound recording and automatic exposure control was developed for use as a television news camera. The major improvements are considered to be: (1) The size of the lens is reduced, the focal distance is enlarged, and a filter-inserting part is provided in the automatic exposure control loop. (2) The amount of light incident on the finder is substantially increased to facilitate focusing. (3) A registration pin is provided to improve the picture steadiness. (4) Simplification of the gear train, and improvement of the drive motor manufacturing method results in noise reduction and mechanical improvements. (5) The size and weight of the sound amplifier unit are reduced and camera handling is made easier by an automatic gain control and integrated circuits. (6) The power supply battery is replaced by a sealed-type cadmium battery, and charging time is reduced.
F.O.S.

N69-31146# Princeton Univ., N.J. Plasma Physics Lab.
AN AUTOMATICALLY SWEPT PHOTOELECTRIC FABRY-PEROT SPECTROMETER
Joseph G. Hirschberg and Ernest L. Wilson Nov. 1968 62 p refs
(Contract AT(30-1)-1238)
(MATT-562) Avail: CFSTI

A pressure-swept photoelectric Fabry–Perot interferometer is shown to be the most advantageous instrument under certain conditions for line breadth measurements. Fabry–Perot theory is summarized, and attention is paid to the choice of the various parameters, mirror reflectivity, intermirror distance, plate flatness, and exit orifice size. Adjustment, calibration, and measurement are described.
Author (NSA)

N69-31150# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
BACKGROUND AND SENSITIVITY OF RADIOPHOTOLUMINESCENT GLASSES: MEASUREMENT VARIATIONS: NEW METHOD OF STANDARDIZATION [PREDOSE ET SENSIBILITE DES VERRES RADIOPHOTOLUMINESCENTS FLUCTUATIONS DES MESURES; NOUVELLE METHODE D'ETALONNAGE]
Anne-Marie Chapuis, Henri Francois, and Monique Pichoret-Chartier Sep. 1968 11 p refs In FRENCH Presented at the 2d Intern. Conf. on Luminescence Dosimetry, Gatlinburg, Tenn., 22 Sep. 1968
(CEA-CONF-1132; CONF-680920-11; Rept-68/17) Avail: AEC Depository Libraries

A new method of dosimeter calibration was developed which consists in defining for each series of measurements made with an apparatus the characteristics of this apparatus. The studies were made on cylindrical dosimeters. The results showed that it was not possible to define the characteristics of radiophotoluminescence glasses. The characteristics of the dosimeter-reader ensemble can be determined. Therefore every modification of the apparatus causes difficulties which can be eliminated by the calibration method proposed. The method consists in calculating for each series of measurements the background and the mean sensitivity of a lot of dosimeters with the reader used. In order to estimate the exposure of a dosimeter it is necessary to know the sensitivity and the background; the precision obtained varies with the method chosen to evalute these parameters and can not be better than that of the reader.
NSA

N69-31154# Cambridge Systems, Inc., Newton, Mass.
THE EXPENDABLE DEW POINT HYGROMETER Final Report, 18 Apr. 1965–31 Dec. 1968
Arthur Bisberg Dec. 1968 53 p ref
(Contract AF 19(628)-5079)
(AD-685174; AFCRL-69-0073) Avail: CFSTI CSCL 4/2

The report presents an engineering description of, and procedures, for utilizing a new expendable, balloon-borne point hygrometer. The hygrometer is of the Freon-cooled, optically detected, automatically controlled condensation type, with mirror temperature read out by a thermistor sensor. The device utilizes low cost solid-state electronics and is compatible with conventional radiosonde telemetry systems. The hygrometer is capable of measurement to -80C and has been successfully flight tested. This document is a combined final report and instruction manual.
Author (TAB)

N69-31245# Environmental Data Service, Silver Spring, Md.
CATALOG OF METEOROLOGICAL SATELLITE DATA: ESSA 3 AND ESSA 5 TELEVISION CLOUD PHOTOGRAPHY, 4 APRIL–30 JUNE 1967
1968 206 p refs /ts Doc. No. 5.314
Avail: SOD $1.75

A series of digitized cloud maps are presented. These photographs were obtained from meteorological satellites, ESSA 3 and ESSA 5. Two photographic maps of the polar stereographic projection (one of the Northern Hemisphere and one of the Southern Hemisphere) are included for each day during April, May, and June 1967.
Author

N69-31332*# Ryan Aeronautical Co., San Diego, Calif.
SCATTEROMETER DATA ANALYSIS PROGRAM Final Report, 1 Jun. 1968–31 May 1969
N. Guillot and S. Benedict 31 May 1969 98 p
(Contract NAS9-8252)
(NASA-CR-101776; Rept-57667-4) Avail: CFSTI CSCL 14B

This work was conducted as part of the NASA Earth Resources Survey Program, in which remote sensing is evaluated for its potential contributions to agriculture, forestry, geology, oceanography, meteorology, urban programs, and others. Specifically, scatterometer signatures, radar signatures, and RF backscattering were analyzed for use in identifying surface parameters. Efficient methods were studied for reducing sensor data and for improving data presentation. Data correlation was performed between 400 MHz and 13.3 GHz scatterometers, and polarization detection as well as polarization effects were studied. Approximately 46 lines of scatterometer data were processed and verified. The output of data processing programs and the validity of algorithms used in digital computer programs were verified. Attempts are described to decrease the turn-around time of data processing by improving the programs.
K.W.

N69-31357*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
SINGLE-CHANNEL INFRARED ASTROPHOTOMETER [ODNOKANALNYY INFRAKRASNYY ASTROFOTOMETR]
G. V. Khozov Washington NASA Jul. 1969 10 p refs Transl. into ENGLISH from Tr. Astron. Observ. (Leningrad), v. 25, no. 337, issue 42, 1968 p 69–77
(Contract NASw-1692)
(NASA-TT-F-12295) Avail: CFSTI CSCL 14B

The infrared astrophotometer is described. The astrophotometer is intended for photometric and polarimetric observations in the 2.0 to 2.5 spectral band. When using the Cassegrain focus of the AZT-3 reflector (D = 45 cm), the sensitivity threshold is 2 magnitudes for the early type stars and approximately 8 to 9 magnitudes for the late type stars.
Author

N69-31358*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
CERTAIN ANALYTICAL RESULTS OF OBSERVATIONS OBTAINED FROM A TRANSIT INSTRUMENT OF THE LENINGRAD STATE UNIVERSITY TIME SERVICE [NEKOTORYYE REZULTATY OBRABOTKI NABLYUDENIY POLUCHENNYKH NA PASSAZHNOM INSTRUMENTE SLUZHBY VREMENI LGU]
M. P. Mishchenko et al. Washington NASA Jul. 1969 9 p refs Transl. into ENGLISH from Tr. Astron. Observ. (Leningrad), v. 25, no. 337, issue 42, 1968 p 131–138
(Contract NASw-1692)
(NASA-TT-F12298) Avail: CFSTI CSCL 14B

The problem of the influence of thermal radiation of time corrections is considered. The errors caused by anomalous refraction in astronomical observations are also studied. Author

N69-31370*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
RADIOHELIOGRAPHS OF EXTREMELY HIGH RESOLUTION [RADIOGELIOGRAFY C PREDELNO VYSOKIM RAZRESHENIYEM]
G. B. Gelfreykh Washington NASA Jul. 1969 14 p refs Transl. into ENGLISH from Tr. Astron. Observ. (Leningrad), v. 25, no. 337, issue 42, 1968 p 87–97
(Contract NASw-1692)
(NASA-TT-F-12296) Avail: CFSTI CSCL 14B

The difficulties of constructing high resolution radioheliographs (several seconds of arc) are considered. It is shown that an increase in the resolving power of a multielement interferometer results in a decrease of its sensitivity. If the resolution is higher than 20 seconds of arc, the signal of the quiet Sun is below its sensitivity threshold. This and other problems are caused by interference from the large, bright surface of the solar disk while only a small section of it is under investigation. Some ways of overcoming these difficulties are pointed out. Author

N69-31374# Institute of Nuclear Research, Warsaw (Poland).
A PRELIMINARY STUDY ON THE ac BRIDGE LEVEL SENSOR FOR LIQUID METALS
Ya. Dzedzits 1968 17 p refs In RUSSIAN; ENGLISH summary
(INR-954) Avail: AEC Depository Libraries

The design of a new type of continuous level gauge for liquid alkali metals in containers is described. An original measurement method is described, based on the basic symmetrical bridge circuit but with closely (100%) inductively coupled opposite arms and (≈ 50%) coupled adjacent arms. Measurements performed on the gage model have confirmed, that the predictions and theoretical considerations were correct. In consequence a prototype of this simple device has been obtained with a very high sensitivity and low temperature dependence. The complete level indicator with this sensor does not need electronic devices and is supplied with 50 ÷ 60 c/sec power network. These features may be considered as two additional advantages of the device. Author (NSA)

N69-31450# Sandia Corp., Albuquerque, N. Mex.
FIELD FRINGING AROUND THE INSULATING GAP IN GUARD RING QUARTZ GAUGES
J. R. Freeman Jan. 1969 38 p refs
(SC-RR-69-55) Avail: CFSTI

The effect of electric field fringing around the insulating gap of a guard ring quartz gage for observing shock waves in the stress region of tens of kilobars with a time resolution of a few nanoseconds was investigated by numerically solving a series of boundary value problems corresponding to different stress front positions. The method of successive over-relaxation with a continuously corrected acceleration factor was used, incorporating a multi-segment, variable density mesh. The calculations indicate that no significant deviations from the one-dimensional model can be attributed to guard ring field fringing. This result was obtained for stress pulse durations both longer and shorter than the stress transit time through the gage, and for wide and narrow guard ring gaps. Author (NSA)

N69-31501*# California Univ., La Jolla. Dept. of Applied Physics and Information Science.
THE APPLICATION OF SIGNAL DETECTION THEORY TO OPTICS Quarterly Progress Report
Carl W. Helstrom 15 Jun. 1969 42 p refs
(Grant NGR-05-009-079)
(NASA-CR-103312) Avail: CFSTI CSCL 17H

By means of the quantum-mechanical form of the Cramer–Rao inequality, a lower bound is set to the mean-square error, in an unbiased estimate of a parameter of an incoherently radiating object, observed in the presence of thermal background light by an optical system admitting light through a finite aperture. Estimates of absolute radiance, frequency, and position of the object are specifically analyzed. The bounds are reduced in the classical limit to those previously obtained, but are valid in the quantum limit as well. It is shown that when the background vanishes, the bounds depend only weakly on the effective number of independent spatial and temporal degrees of freedom of the object light at the aperture. Author

N69-31502# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
POTENTIAL OF HOLOGRAPHY FOR IRRADIATED MATERIALS TESTING
B. B. Brenden and B. P. Hildebrand Nov. 1968 27 p refs Presented at the Remote Handling and Examination in the Fast Reactor Field Meeting, Idaho Falls, Idaho, Nov. 1968
(BNWL-SA-2220; CONF-690305-2) Avail: CFSTI

Holography is a technique of imaging which permits interferometric comparisons of a diffusely reflecting object of complex configuration with the same object under a different stress loading for purposes of studying the distribution of strain. Holography has also been applied with considerable success to acoustical imaging. The progress of stress corrosion cracking can be studied by application of a combination of holographic interferometry, acoustical holography and acoustical emission techniques. It also seems likely that holographic interferometry will become a powerful tool in tensile testing. Author (NSA)

N69-31526# Army Materials and Mechanics Research Center, Watertown, Mass.
A NEW AXIAL TENSION TESTER FOR BRITTLE MATERIALS
Francis I. Baratta and George W. Driscoll Jan. 1969 48 p refs
(AD-685835; AMMRC-TR-69-02) Avail: CFSTI CSCL 14/2

A unique and accurate device aimed specifically at tension testing of brittle materials has been devised. This device effectively minimizes in a simple manner parasitic bending stresses that usually arise in conventional tension testing. The text gives the reasons for minimization of these errors as well as the results of an experimental test program which showed that these errors were small. A comparison of the results obtained from this proposed method of testing to those already in practice is included in the report. Author (TAB

N69-31625# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

X-RAY DETERMINATION OF ELASTIC CONSTANTS E AND NU

M. N. Shved Jan. 1969 12 p refs Transl. into ENGLISH from Vopr. Mekhan. Real'Nogo Tverd. Tela (Kiev), 1964 p 128–135

(AD-685028; FTD-HT-23-1137-68) Avail: CFSTI CSCL 20/11

The existing method of x-ray determination of elastic constants requires several tens of x-ray photographs to be taken, which is very tedious. In order to simplify the method of determining the elastic constants, the author transforms the formulas of the relative strains in different directions for the case of a linear strained state in such a way that the stresses and modulus of elasticity are eliminated. Poissons coefficient then is expressed in terms of three interplane distances of the atomic planes. As a result, for the determination of Poissons coefficient, one may confine oneself to taking only three x-ray photographs. To find the modulus of elasticity one needs also to know the stresses arising in the object. The author shows that a similar method also is possible for the plane stressed state, but that in this case at least four x-ray photographs must be taken. TAB

N69-31633# Cornell Aeronautical Lab., Inc., Buffalo, N.Y. Aerodynamic Research Dept.

THE CAL SHOCK-TUBE-DRIVEN MOLECULAR BEAM: ENGINEERING DETAILS AND SURVEY DATA

George T. Skinner Jan. 1969 62 p refs

(Contract AF 49(638)-1490)

(AD-685787; CAL-RM-2028-A-1; AFOSR-69-0791TR) Avail: CFSTI CSCL 20/7

The design considerations, engineering details, and beam survey data relevant to a shock-tube-driven molecular beam are presented in detail in this report. The survey data are for an N2 beam with a kinetic energy per molecule of 1.3 ev, and two Ar beams of 1.4 and 2.2 ev. The spreading angles of these beams are of the order of 1 degree. Sufficient engineering details are presented to show how all the elements of the apparatus, including a target beam, function and how they are synchronized with the firing of the shock tube. Author (TAB)

N69-31635# Sandia Corp., Albuquerque, N. Mex.

CATHODE RAY TUBE COLOR PLOTTING

C. J. Fisk Jan. 1969 16 p refs

(SC-RR-68-546) Avail: CFSTI

Modifications to a commercially available cathode ray tube plotter (Stromberg Carlson 4020) have been made by Sandia to allow direct-color film exposure. Hardware of the plotter was modified and three unused programming commands were utilized to allow color control by the user in the FORTRAN programming language. The user can thus produce either color movies or slides. An additional facility to reduce programming effort has been provided so that slides can be generated merely by entering data, thus allowing nonprogramming personnel to use the system easily. Author (NSA)

N69-31663# DASA Data Center, General Electric Co., Santa Barbara, Calif. DASA Information and Analysis Center.

CONCEPTS IN SPECTRAL UNFOLDING

Gerald I. Kerley Feb. 1969 22 p refs

(Contract DASA01-68-C-0007)

(AD-686109; DASIAC-SR-86; DASA-2242) Avail: CFSTI CSCL 09/4

The report discusses the problem of unfolding spectral information from a set of measured data, using response functions of the experimental apparatus. General concepts, applicable to a number of unfolding problems, are developed in terms of a basic Fredholm equation. Particular emphasis is placed upon methods for determining the errors and resolution of unfolded data. Author (TAB)

N69-31687*# Case Western Reserve Univ., Cleveland, Ohio. School of Engineering.

SILICON SURFACE PASSIVATION FOR DEVICES Quarterly Status Report

Alan B. Kuper 1 Jun. 1969 33 p refs

(Grant NGR-36-003-067)

(NASA-CR-103315; QSR-3) Avail: CFSTI CSCL 14B

Water-film conductance feasibility studies were made which led to a novel pre-screening technique called transient differential quench (TDQ). The TDQ conductance effect is observed with relatively high humidity. Approximately 100 encapsulated diodes were tested, measuring reverse current (I_r) vs. voltage (V), temperature (T), and time (t) using three pre-screen techniques: (1) I_r vs. V hysteresis, T from T_{room} to 77°K; (2) I_r vs. t in TDQ quenching to 0°C; and (3) I_r vs. t after application of V. Results indicate that (1) may be a useful pre-screen, (3) appears to be a simple pre-screen. Results with (2) on diodes are negative. Author

N69-31718# Dow Chemical Co., Golden, Colo. Rocky Flats Div.

OPTICAL CALIPER

L. William Utley 24 Feb. 1969 19 p refs

(Contract AT(29-1)-1106)

(RFP-1144) Avail: CFSTI

An Optical Caliper, being designed and constructed for absolute, noncontact measurements of length or diameter without the use of a master reference part, is described. The instrument utilizes two white-light interference microscopes as null positioners and a laser fringe-counting interferometer as the actual measurement means. The instrument is capable of a measurement range from zero to six inches. Details of the microscopes, reference standard, and fringe-counting interferometer are given, together with an analysis of measurement error. Author (NSA)

N69-31738# Edgerton, Germeshausen and Grier, Inc., Bedford, Mass.

SPECIALIZED PHOTOSENSITIVE MATERIALS FOR LASER RESEARCH Final Report, 1 Jul. 1967–31 Jan. 1968

Charles W. Wyckoff, John D. Plumadore, and Ronald Francis 30 Sep. 1968 116 p refs

(Contract F19628-67-C-0389; ARPA Order 450)

(AD-686118; B-3877; AFCRL-68-0504) Avail: CFSTI CSCL 14/5

Limitations of commercially available photographic materials for application in laser emission studies are described in terms of spectral response, sensitivity level, short dynamic exposure range and low tolerance to high energy densities. Commercially available XR film, which has a uniform response for visible light photography spanning nearly eight orders of magnitude, is not optimally suited for laser emission studies at > 6900Å nor does its high specular diffuse density allow the film to endure energies > 0.1 joule/sq cm. The results of studies with silver halide and photochromic emulsions and special XR film models specifically designed for use with laser emissions are summarized. The silver halide films not only have a 10 to the 9th power dynamic range of exposure, but are responsive to a broader spectral range including wavelengths in the one micron region and have exhibited toleration to energy densities of 45 joules/sq cm. Further response to 10.6 micrometer was found in photochromic films. Author (TAB)

N69-31742# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Chemistry and Chemical Engineering.
THERMOMECHANICAL STUDIES OF POLYMER DEFORMATION. PART 1. A NEW DEFORMATION CALORIMETER
I. J. Duvdevani, J. A. Biesenberger, and C. G. Gogos Apr. 1969 22 p refs
(Contract N00014-68-A-0131)
(AD-686078; TR-7) Avail: CFSTI CSCL 14/2

The purpose of the paper is to describe a new deformation calorimeter, which is based on differential thermometry and uses a flowing gas stream as a heat transfer medium which allows it to operate under near-isothermal conditions. Also presented are some preliminary test measurements with a crosslinked polyurethan elastomer and crystalline polybutene-1. Author (TAB)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N69-30401*# National Aeronautics and Space Administration, Washington, D.C.
INTERDISCIPLINARY APPROACH TO FRICTION AND WEAR Conference Proceedings
P. M. Ku, ed. (Southwest Res. Inst.) GPO 1968 489 p refs NASA-sponsored Symp. held in San Antonio, Tex., 28–30 Nov. 1967
(NASA-SP-181) Avail: SOD $2.25; CFSTI CSCL 11H

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N69-30404*# Rensselaer Polytechnic Inst., Troy, N.Y.
SURFACE INTERACTIONS IN SLIDING
F. F. Ling *In* NASA, Washington Interdisciplinary Approach to Friction and Wear 1968 p 143–179 refs (See N69-30401 17-15)
Avail: SOD $2.25; CFSTI CSCL 11H

Various actions at the surfaces and domain of influence, occasioned by two bodies in sliding contact, are viewed in totality through irreversible thermodynamics. Because of the complexity of these actions, quantitative treatments exist for only one or more of these actions in a single analysis. Topics summarized are surface temperatures, thermomechanical coupling, surface behavior of composites, model surfaces, and the implication of these on friction and wear. Author

N69-30405*# Cincinnati Milling Machine Co., Ohio.
FRICTION AND ADHESION
M. E. Merchant *In* NASA, Washington Interdisciplinary Approach to Friction and Wear 1968 p 181–265 refs (See N69-30401 17-15)
Avail: SOD $2.25; CFSTI CSCL 11H

The understanding of the fundamentals of friction and adhesion are reviewed. Adhesion, a major factor in the friction process, is presented as an inherent action of most solid bodies when brought into contact. Its effects, however, are normally masked by surface contamination, very limited area of actual contact, and the effects of elastic recovery. Friction, then, results primarily from the force required to shear the junctions formed (or the contaminant films present) at the areas of actual contact, the area to be sheared being virtually proportional to the applied load in all normal cases. Author

N69-30406*# Leicester Univ. (England).
WEAR
J. F. Archard *In* NASA, Washington Interdisciplinary Approach to Friction and Wear 1968 p 267–333 refs (See N69-30401 17-15)
Avail: SOD $2.25; CFSTI CSCL 11H

The development of fundamental knowledge of wear is reviewed with special emphasis upon the unlubricated wear of metals. One aspect which has received some attention is the classification of wear, and some classifications are critically reviewed in the light of the experimental evidence of wear studies. Analytical theories of wear have a value in providing a more exact statement of assumed mechanisms of wear and also provide a basis for comparison between theory and experiment; values of the wear factor, K, of the theories are deduced from such comparisons. There is a need for physical explanations of these K factors which can be confirmed by subsidiary experiments. With a few combinations of materials, the mechanisms of wear are well understood; but the extent to which these same mechanisms apply to a wider range of materials is questioned. Moreover, most of the evidence is drawn from experiments with metallic materials, whereas one might expect the bonding within the material to exercise a major influence upon its wear behavior. Author

N69-30407*# Chevron Research Co., Richmond, Calif.
BOUNDARY LUBRICATION
D. Godfrey *In* NASA, Washington Interdisciplinary Approach to Friction and Wear 1968 p 335–384 refs (See N69-30401 17-15)
Avail: SOD $2.25; CFSTI CSCL 11H

This review discusses boundary lubrication in terms of the lubricating films on sliding surfaces. Films are formed by physical

adsorption, chemisorption, and chemical reaction. The physical properties of the films, particularly melting point, shear strength, hardness, and adhesion to the surface, are important to lubrication. Film failure mechanisms include desorption, melting, solution, discontinuity, detachment, and rupture. This review also reveals that there is no adequate theory for boundary lubrication, and that there is a lack of knowledge of the chemical composition of films on sliding surfaces and on their physical properties under conditions of high pressure, high shear rate, and high temperature. Author

N69-30408*# Cambridge Univ. (England).
CRITICAL APPRAISAL AND RESEARCH OPPORTUNITIES: THE LUBRICATION RESEARCH VIEWPOINT
D. Tabor *In* NASA, Washington Interdisciplinary Approach to Friction and Wear 1968 p 385–432 refs (See N69-30401 17-15)
Avail: SOD $2.25; CFSTI CSCL 11H

This critique attempts to elucidate the main problems in the fields of friction, lubrication, and wear, and to indicate those areas where useful contributions can be made. Specific points are discussed further which were brought up by other speakers at this conference. B.P.

N69-30409*# Virginia Univ., Charlottesville.
CRITICAL APPRAISAL AND RESEARCH OPPORTUNITIES: THE MATERIALS RESEARCH VIEWPOINT
K. R. Lawless *In* NASA, Washington Interdisciplinary Approach to Friction and Wear 1968 p 433–478 refs (See N69-30401 17-15) refs
Avail: SOD $2.25; CFSTI CSCL 11H

An overall evaluation is attempted of the current state of knowledge of friction and wear as viewed from the standpoint of a materials scientist. The lectures of this symposium are used as the basis of the discussion, as well as the comments of the participating scientists. Among the conclusions reached were: definitive experiments on adhesion are clearly a necessity, as are refined studies of the deformation and fracture processes. In the usual friction and wear process, a very large number of variables may be involved; if any understanding is to be achieved, simpler systems must be studied initially so that the influence of the variables may be evaluated one at a time. B.P.

N69-30436 Illinois Univ., Urbana.
SYNTHESIS OF TOOTH PROFILES AND GEARS FOR INCREASED LOAD CAPACITY BASED UPON HERTZ SURFACE PRESSURE CONSIDERING CONTACT RATIO AND BENDING STRENGTH
Alan Otto Labeck (Ph.D. Thesis) 1968 247 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.20 Order No. 69-1382

The theory and methods of solution for the synthesis of spur gear tooth profile shapes of the non-involute type based on the Hertz surface pressure are described. The synthesized profile was incorporated by further synthesis into a gear having increased load capacity compared to the standard involute gear. A differential equation was developed which relates the profile shape to the Hertz surface pressure. The simultaneous solution of this equation with the differential equation representing the fundamental law of gear tooth action results in tooth profile shapes having a specified load capacity based on the criterion of Hertz surface pressure. Methods were developed to incorporate this profile into a practical gear design by considering such factors as bending strength, contact ratio, numbers of teeth, and speed ratio. Dissert. Abstr.

N69-30530*# Scripta Technica, Inc., Washington, D.C.
MEAN TEMPERATURE DIFFERENCE IN LOW-PRESSURE VAPOR GENERATORS AND CONDENSERS
P. L. Kirillov *In its* Liquid Metals May 1969 p 287–293 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 13A

The paper studies the behavior of liquid metal vapors as a heat transfer medium. A new expression for the log mean temperature difference is obtained for both parallel and counterflows. Author

N69-30537*# Scripta Technica, Inc., Washington, D.C.
MAXIMUM PERMISSABLE LEAKAGE IN A SODIUM-TO-WATER STEAM GENERATOR
N. N. Ivanovskiy et al *In its* Liquid Metals May 1969 p 357–359 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 13A

Presented is a set of conditions for calculating the maximum permissible leakage in a liquid sodium steam generator. Safety factors are considered. Author

N69-30539*# Scripta Technica, Inc., Washington, D.C.
HEAT EXCHANGERS OF EXPERIMENTAL LIQUID-METAL LOOPS
V. A. Kurov et al *In its* Liquid Metals May 1969 p 368–376 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 13A

The paper presents design criteria and operating procedures for heat exchangers associated with liquid metal loops. Liquid-metal-to-water coolers, liquid-metal-to-air coolers, as well as liquid metal-to-liquid-metal exchangers and recuperators are described. Author

N69-30541*# Scripta Technica, Inc., Washington, D.C.
ELECTROMAGNETIC AC PUMP FOR LIQUID METALS RATED AT 120 CUBIC METERS PER HOUR
Ye. M. Avilova et al *In its* Liquid Metals May 1969 p 385–388 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 13K

The physical features, design characteristics and performance data for a 120 m^3/hr electromagnetic A-C pump for circulating liquid metals are presented. Author

N69-30542*# Scripta Technica, Inc., Washington, D.C.
ELECTROMAGNETIC SCREW PUMP FOR PUMPING OF LIQUID METALS
Ye. M. Avilova et al *In its* Liquid Metals May 1969 p 389–391 (See N69-30507 17-33)
Avail: CFSTI CSCL 13K

The design features and operating characteristics of an electromagnetic screw pump are given. The pump is well suited for laboratory-scale tests with liquid metals. Author

N69-30543*# Scripta Technica, Inc., Washington, D.C.
HYDROSTATIC BEARINGS IN SODIUM PUMPS
N. N. Aristarkhov et al *In its* Liquid Metals May 1969 p 392–402 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 13K

The design of hydrostatic bearings for sodium pumps is considered. Operating principles of the bearings, temperature resistance, pressure, wear, and noise were tested in a sodium loop. Creep was also considered at temperatures up to 400°C. Author

N69-30546*# Scripta Technica, Inc., Washington, D.C.
FROZEN SODIUM SEALS
A. V. Drobyshev et al *In its* Liquid Metals May 1969 p 412-436 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 11A

Presented are the results of a thorough engineering study of frozen liquid metal seals. A method for calculating the startup forces of such seals is given. Stress-strain diagrams for sodium are given for different strain rates and different temperatures. Characteristics of several designs of frozen sodium seals were studied. Comparison of theoretical and experimental data shows satisfactory agreement. Author

N69-31014# Notre Dame Univ., Ind. Coll. of Engineering.
THE APPLICATION OF MICROPOLAR MECHANICS TO COMPOSITES
Roger E. Hoffman and Teoman Ariman Dec. 1968 51 p refs
(Contract N00014-68-A-0152; Proj. THEMIS)
(AD-684884; THEMIS-UND-68-3) Avail: CFSTI CSCL 13/10.1

In this report the theory of micropolar continua has been used to analyze the stresses and displacements within the separate components of a fibrous composite material. The separate constituent materials are assumed to be linearly micropolar elastic, isotropic, and homogeneous. A model chosen consists of parallel fine fibers, embedded in a matrix material. The problem is formulated as one of plane micropolar elasticity and solved for some special cases. Various numerical results are presented and compared to those of the classical and indeterministic couple stress theories. Author (TAB)

N69-31067# Boeing Co., Seattle, Wash. Office of International Operations.
TESTING MACHINES FOR METALLIC MATERIALS
G. Jacoby Apr. 1969 47 p refs Transl. into ENGLISH from German report No. DVL-865
(F-268; DVL-865) Avail: CFSTI

The design of testing machines for metallic material is governed by several requirements as to better use of common material, introduction of new material, synergism in material testing, and automatic control of testing procedures. Application of these criteria to the design of tensile-testing machines brings up the question of how to realize an intertialess load-measuring device and a constant high strain rate. In finding the fatigue strength, a wide frequency range is desirable. Improving the accuracy of measurement seems to be logical only if other factors influencing the specific stray field of a certain vibratory testing machine can be controlled to a higher extent. To analyze the durability of a material, tests under working conditions and random load tests are conducted in addition to Wöhler-tests. For that purpose the setting means have to meet certain specifications. Author

N69-31093# Technical Univ. of Norway, Trondheim. Engineering Research Foundation.
WEAR DURING SLIDING: EXPERIMENTS ON COMPARISON OF TEST METHODS
R. Ostvik 19 Oct. 1966 26 p
Avail: CFSTI

Systematic measurements of friction and wear of five different materials sliding against two reference steels under lubricated and dry conditions were made. The tests were performed in a crossed cylinder machine under conditions of pure sliding. For some of the experiments, the machine was modified to a pin-cylinder configuration. The results show a large difference in wear rate among the five materials, and in the effect of load on wear rate. Author

N69-31275*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DUCT COUPLING FOR SINGLE-HANDED OPERATION
William N. Meyers inventor (to NASA) Filed 5 Jun. 1969 8 p
(NASA-Case-MFS-20395; US-Patent-Appl-SN-830715) Avail: CFSTI CSCL 13I

A device is described which is designed for quickly connecting or disconnecting a pair of duct sections. A first duct section receives telescopically the end of a second duct section. A series of spring-biased latches carried by the first section snaps into locking engagement with the second section. The first duct section has a ring which, by rotating, engages the latches. Unlocking is also initiated by rotation of the ring. Rotation of the ring is accomplished by manipulating a handle carried by the first duct section. The specific purpose of the device is to provide an easy way for astronauts to make duct couplings single-handedly in the zero-gravity environment of a spacecraft. NASA

N69-31316# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
PNEUMATIC HEADGATE VALVE CONTROLLER
R. Donald Bowdey 26 Feb. 1969 10 p refs
(Contract AT(29-1)-1106)
(RFP-1140) Avail: CFSTI

In vacuum processes requiring partial pressure during experiments, there is a problem of reaching the desired pressure level and maintaining the pressure with an oil diffusion pumped vacuum system. A novel method of throttling the headgate valve in an oil diffusion pumped system is described which permits maintaining the partial pressure. Author (NSA)

N69-31329*# General Motors Corp., Santa Barbara, Calif. Defense Research Lab.
RESILIENT WHEEL
John N. Calandro, inventor (to NASA), Norman J. James, inventor (to NASA), and Ferenc Pavlics, inventor (to NASA) Filed 17 Feb. 1969 11 p
(Contract NAS8-20267)
(NASA-Case-MFS-13929; US-Patent-Appl-SN-799847) Avail: CFSTI CSCL 13I

The wheel described here is tubular in cross section and has a woven wire tire clamped to the rim of a conical wheel disc. The tread surface of the wire has tread units made up of abrasive coated strips clamped to the wire tire and arranged in a herringbone pattern around the tread area of the tire. A relatively rigid annular frame is provided inside the wire tire to limit deflection of the tire under load. The wheel is especially suited for use on lunar vehicles. NASA

N69-31344*# Rocketdyne, Canoga Park, Calif.
TEMPERATURE SENSITIVE FLOW REGULATOR
Lloyd E. Tomlinson, inventor (to NASA) Filed 27 Dec. 1968 11 p
(Contract NAS8-19)
(NASA-Case-MFS-14259; US-Patent-Appl-SN-787410) Avail: CFSTI CSCL 13I

A device is described which controls the flow rate of a fluid in a duct in response to a change in temperature. The device permits a uniform flow through a fixed orifice in the duct and a variable flow through holes in the walls of two nested metallic sleeves of truncated-cone structure. The sleeves are of metallic materials having different thermal expansion; this causes them to slide and change diameter relative to each other in response to temperature changes. The relative movement of the sleeves varies the amount of flow space area through the walls of the sleeves. An application of the device is in rocket engines where it may be desirable to employ a self-contained device to vary the flow rate of gases in an engine ducting system. NASA

N69-31363# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DETECTING SOURCES OF BINDING ON THE FRICTION SURFACES OF MACHINE PARTS BY SPECTRAL ANALYSIS

B. I. Kostetskii, N. P. Ryzhikh, and M. E. Natanson Oct. 1968 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinotro. (Moscow), no. 9, 1967 p 51–53

(AD-685513; FTD-MT-24-327-68) Avail: CFSTI CSCL 13/9

The article describes a method of detecting sources of binding on the surfaces of a friction pair by using spectral analysis. The results are given an investigation of the rules of metal transfer in a friction pair under conditions of lubrication and dry friction. Results are given of the investigation of friction surfaces of the materials in real friction units of machines. Author (TAB)

N69-31365*# Hydraulic Research and Mfg. Co., Burbank, Calif.

INNER LOOP INTEGRATOR FEASIBILITY STUDY Final Report

S. M. Goldstein 15 Jul. 1968 111 p

(Contract NAS8-20730)

(NASA-CR-102220; HR-73900000) Avail: CFSTI CSCL 13I

The feasibility of a concept for making a hydromechanical actuator exhibit infinite static stiffness is presented. The effort was particularly applied to a flight-type actuator configuration embodying the sizing and performance requirements of servoactuator P/N 1052350. Initially, an analytical study of the concept operating on MIL-H-5606 oil was accomplished by linear analysis techniques. The results obtained were verified by a nonlinear computer simulation. Conceptual feasibility was concluded with a hybrid evaluation test series in which the proposed modifications to P/N 1052350 were simulated by an analog computer. Performance tests were conducted using an inertial load on the S1-C load simulator. Finally, pneumatic system performance using 2000 psi ambient temperature nitrogen gas was investigated by analog simulation. Author

N69-31489*# Air Products and Chemicals, Inc., Allentown, Pa. Advanced Products Dept.

HYDROGEN RELIQUEFIER Quarterly Report, 27 Sep.–26 Dec. 1967

E. B. Kunkle, R. N. Meier, M. A. Benning, R. E. Luybli, and J. R. Marple 15 Jan. 1968 54 p

(Contract NAS8-21203)

(NASA-CR-102219) Avail: CFSTI CSCL 13I

A summary of the hydrogen reliquefier project for the second three months interval of a fourteen month program is presented. Major emphasis has been placed on investigating the operating characteristics of the reliquefier cycle. A computer program was developed to simulate the operation of a reliquefier of fixed compressor and expander geometry and fixed transfer units in each of the two heat exchangers. This program was used to predict the actual behavior of a reliquefier when exposed to variations in reliquefier inlet conditions, heat exchanger transfer units, and relative compressor to expander flow rates. The results show that the relative flow split between the compressor and expander has the greatest influence on the attainable reliquefaction fraction. Consequently the reliquefier design considers several ways of providing adjustment to these relative flow rates to ensure successful reliquefier operation. Author

N69-31503# Oak Ridge National Lab., Tenn.

WRIST-ACTION MANIPULATORS FOR SHIELDED GLOVE BOXES

M. T. Morgan Apr. 1969 13 p refs

(Contract W-7405-eng-26)

(ORNL-TM-2512) Avail: CFSTI

Commercial manipulators for use with shielded glove boxes do not have the dexterity necessary for many operations. A wrist-action manipulator is described that will perform many operations which were not possible with the old style manipulators, and will also reach areas in the box which were previously inaccessible. Author (NSA)

N69-31529# Harry Diamond Labs., Washington, D.C.

FLUIDIC GAS DIVERTER VALVES

Allen B. Holmes and Stacy E. Gahman Feb. 1969 44 p ref

(AD-686280; HDL-TR-1427) Avail: CFSTI CSCL 13/7

A V/STOL configuration using turbojet exhaust for hovering and jet thrust for propulsion requires the use of high-capacity diverter valves. A study was conducted to investigate the application of fluidic principles to V/STOL diverter valve design. During the program, three subscale valves were built and tested. Each valve has two outputs, one feeding a simulated tail exhaust pipe and one exhausting directly to atmosphere. The operation of each valve depends upon the viscous interaction between a turbulent flow and a wall. The objective is to establish the flow diversion capabilities and jet mode thrust performance of each model. Flow tests were conducted using compressed air at flow rates ranging to 3000 cfm at 30 psi. The impulse delivered at the output of each valve was measured in terms of the developed thrust per unit mass flow over a range of supply pressures. Data representing the ratio between deliverable impulse and isentropic impulse are included to provide a means for comparing the designs. Author (TAB)

N69-31549# Air Force Machinability Data Center, Cincinnati, Ohio.

SUPPLEMENT TO MACHINING DATA FOR NUMERICAL CONTROL (1968)

Michael Field, Clarence L. Mahl, and John F. Kahles Aug. 1968 106 p refs

(Contract AF 33(615)-5262)

(AD-675341; AFMDC-68-2) Avail: CFSTI CSCL 13/8

This report presents an extensive set of machining data selected from the latest USAF Machinability Report. Data are tabulated and arranged in formats including machining variables such as tool materials, tool geometry, cutting fluid, depth, width, feed, and tool life end point. For each of the data lines, the relationship between tool life and cutting speed is expressed in at least three sets of data, thereby making it possible to optimize for maximum production or minimum cost. While these data are expected to be of considerable assistance in providing data for numerical control applications, they are also of great value in any type of machining situation involving the materials for which machining data are presented. Author

N69-31550# Air Force Machinability Data Center, Cincinnati, Ohio.

DETERMINATION AND ANALYSIS OF MACHINING COSTS AND PRODUCTION RATES USING COMPUTER TECHNIQUES

Michael Field and Alan F. Ackenhausen Aug. 1968 128 p refs

(Contract AF 33(615)-5262)

(AD-675340; AFMDC-68-1) Avail: CFSTI CSCL 13/8

Equations are presented for determining the cost per piece and production rate for the major machining operations of turning, milling, drilling, reaming, and tapping. To use these equations it is necessary to have tool life data for the actual machining conditions to be used. Fortran computer programs have been written, for an IBM 1130 computer, to calculate and printout the cost per piece and the production rate for the above operations. A detailed cost breakdown is also printed out to facilitate analysis of the significant factors affecting the total cost per piece. Flowcharts, computer program listings, and data format sheets are presented. Author

N69-31680# California Univ., Livermore. Lawrence Radiation Lab.
THE 2X VACUUM SYSTEM
C. J. Anderson 20 Mar. 1969 12 p refs Presented at Symp. on Eng. Probl. of Fusion Res., Los Alamos, N. Mex., 8–11 Apr. 1969 Submitted for Publication Sponsored by AEC
(UCRL-71543; Conf-690407-4) Avail: CFSTI

The 2X vacuum system equipment and method of operation are described. Operating pressures of the order of 2 to 3 × 10^{-9} torr and base pressures of the order of 5 to 8 × 10^{-10} torr are obtained in a mildly baked aluminum and glass vessel of 11,000 liters. Seals are aluminum foil, TFE, Hycar, and epoxy. Titanium sublimation onto LN_2 cooled liners is used with mercury diffusion pumping. The nature of the resulting vacuum is discussed with particular regard to the predominant residual gas methane. Author (NSA)

N69-31704# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
WINDING LONG, SLENDER COILS BY THE ORTHOCYCLIC METHOD
Haldor W. C. Aamot Feb. 1969 15 p refs
(AD-685848; CRREL-SR-128) Avail: CFSTI CSCL 14/2

Thermal probes, like certain rockets and torpedoes, contain power and guidance wire for trailing payout. This wire must be wound into long, slender coils to obtain a slim profile, with a winding pattern of high density and perfect regularity to assure reliable payout from inside the mandrel-less coils. The development of a winding capability using the orthocyclic method solved problems of maintaining complete control of the winding pattern throughout the whole coil. A collapsible, grooved mandrel was developed which can be readily removed from the finished coil for reuse. Coils were wound with diameters of up to 8.5 cm and lengths up to 79 cm with wire lengths to 2100 m. Author (TAB)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N69-30421 Illinois Univ., Urbana.
OPTICALLY PUMPED THIN PLATELET SEMICONDUCTOR LASERS
Milo Reed Johnson (Ph.D. Thesis) 1968 70 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-1366

Thin, homogeneous, single-crystal platelets of CdSe and $CdSe_{1-x}S_x$ were grown by a simple open-tube vapor transport method which employs sublimation of powdered source compounds in the presence of a slow argon stream. Also, thin platelets of GaAs and $GaAs_{1-x}P_x$ were prepared from oriented single-crystal wafers of the bulk material by the sequence of grinding, polishing, and etching. Samples of these semiconductor materials were prepared for optical pumping experiments by cleaving the platelets along crystallographic planes, which provides Fabry–Perot resonator structures. Semiconductor diode lasers fabricated from p-n junctions in high quality $GaAs_{1-x}P_x$ were used as optical pumping sources for experiments at temperatures of about 77°K. Thin platelet samples of $CdSe_{1-x}S_x$ or $GaAs_{1-x}P_x$ are attached with a thin film of oil directly to a resonator face of the pump diode laser. Dissert. Abstr.

N69-30468 Stanford Univ., Calif.
MODE COUPLING EFFECTS WITH RUBY LASERS
Roger Louis Kohn (Ph.D. Thesis) 1968 157 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-243

Mode-coupling effects in lasers were investigated both experimentally and theoretically. Basic considerations indicated that the axial modes of oscillation of a laser can be coupled to produce a power output in the form of a pulse train with pulses whose width is inversely proportional to the active laser gain frequency linewidth. In addition, similar considerations indicated that the technique of mode coupling permits an increase in average harmonic power generated by a laser. A preliminary estimate of the increase of average second-harmonic power produced with a coupled-mode laser, above that generated by a normal multimode laser, rendered the enhancement ratio N/3, where N is the number of active axial modes. This research was undertaken in order to theoretically predict and experimentally verify second-harmonic power enhancement. In the process it was necessary to develop a greater understanding of the behavior of a coupled-mode transient laser. Dissert. Abstr.

N69-30817# Commissariat a l'Energie Atomique, Limeil-Brevannes (France). Centre d'Etudes
COLLECTIVE SCATTERING OF LASER LIGHT AT 90 DEG FROM A NONCYLINDRICAL Z DISCHARGE [DIFFUSION A 90 DEG DE LA LUMIERE LASER PAR UNE DECHARGE Z DISCHARGE]
J. P. Basconnet, G. Cesari, A. Coudeville, and J. P. Watteau [1968] 13 p In FRENCH Presented at Conf. on Plasma Diagn, Culham, Gt. Brit., 19–22 Aug. 1968
(CEA-CONF-1036; CONF-680831-1) Avail: AEC Depository Libraries

The electron density and temperature of a deuterium plasma were measured by scattering of laser light, due to the fluctuations of electron density. The spectrum of the scattered light depends on the value $\alpha = 1/(|k_0 - k_1|) \cdot \lambda_D$, where k_0 and k_1 are the incident and scattered wave vectors and λ_D is the Debye length. Beginning with a 20-kV, 3-kj condenser, a linear discharge is produced in a pyrex revolution chamber, having a central bulge and two symmetric constrictions. A 100-MW ruby laser is used and the scattered light is observed perpendicularly to the incident beam. A part of the scattered light gives the intensity of all the scattered spectrum, whereas the other is analyzed by a spectroscope. The resolution of the spectrum is done by using 10 channels with glass fibers, coupled with 10 photomultipliers and oscilloscopes. The electron component of the measured spectrum, as a function of α and T_e, is compared to the theoretical profiles of Salpeter. Author (NSA)

N69-30676 Hawaii Univ., Honolulu.
THE DEVELOPMENT OF A GAS LASER SYSTEM FOR THE MEASUREMENT OF ATOMIC PARAMETERS AND ITS APPLICATION TO SOME ENERGY LEVELS IN NEON
Roger Alan Lilly (Ph.D. Thesis) 1968 138 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-16953

This dissertation describes the development of a gas laser system for the measurement of atomic parameters. The system has been applied to the measurement of transition probabilities and collision excitation cross sections in neon. The experimental technique utilizes a helium–neon laser oscillating at 3.39 microns, $3s_2$–$3p_4$ (Paschen notation), to perturb the population density of the $3s_2$ level in a neon discharge. This perturbation is coupled to the $3s_3$ neon level through nonradiative collision induced transitions. The perturbations of the excited state population densities are followed by observing the intensity changes in spontaneous emission from these levels. Dissert. Abstr.

N69-30894 University of Southern Calif., Los Angeles.
INVERSE-BREMSSTRAHLUNG PROCESSES IN LASER INDUCED GAS BREAKDOWN
Patrick Clinton Arnett (Ph. D. Thesis) 1968 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-603

A theoretical investigation of the processes whereby intense oscillating electromagnetic fields, such as occur in focused laser beams, give rise to ionization of gases is presented. The important process is found to be inverse-bremsstrahlung. Under the experimental conditions in which the breakdown of gases by focused, Q-switched lasers was studied, electric fields of the order of 10^7V/cm are present, and one theoretical investigation shows that for fields of this intensity a perturbation method in powers of the oscillating field is only slowly convergent. At the low electron energies involved, a method starting from an exact solution of the quantum equations for an electron in an oscillating electromagnetic field, and treating the atomic potential as a perturbation, is unsatisfactory. An integral equation method was developed, capable of solution by iteration, which may be expected to give reasonable results. Dissert. Abstr.

N69-31163# National Lead Co. of Ohio, Cincinnati.
EXPERIMENTAL USE OF A LASER TO PENETRATE URANIUM
H. Y. Spitz Mar. 1969 19 p refs
(Contract AT(30-1)-1156)
(NLCO-1032) Avail: CFSTI

A theory was developed to predict the amount of material excavated from a uranium target by a laser beam. Experimental data, obtained by use of a pulsed CO_2 laser, confirmed the theoretical predictions and demonstrated that penetrability decreased with increasing hardness of the target. Author (NSA)

N69-31252# Tufts Univ., Medford, Mass. Dept. of Physics.
LASER-INDUCED POLARIZED PHOTON BEAM AT THE CAMBRIDGE ELECTRON ACCELERATOR
Mircea Fotino, Richard H. Milburn, Jon R. Sauer, and Charles K. Sinclair Cambridge, Mass. Cambridge Electron Accelerator 15 Nov. 1968 41 p refs
(Contracts AT(30-1)-1984; AT(30-1)-2076)
(CEAL-1046) Avail: CFSTI

The technical characteristics and status of the CEA program initiated in 1964 on the development of laser-induced photon beams are reported. It is shown that beams of such photons can be obtained routinely for use in certain high energy experiments in which low intensities are compensated by a high degree of polarization and a harder energy spectrum. The present level of a few thousand photons per pulse is found to be more than satisfactory for bubble chamber applications. The applicability of the laser beam as a nondestructive probe for beam studies was also demonstrated by measuring the distribution of particle densities in space and time. Attention is drawn to the applicability of this technique to similar beam studies in electron and possibly proton storage rings and particularly to the analysis of interacting beams in regions inaccessible by other methods. NSA

N69-31265# Control Data Corp., Melville, N.Y. TRG Div.
A THEORETICAL STUDY OF LASER OSCILLATION
Maurice C. Newstein and Stephen R. Barone Jul. 1968 19 p refs
(Contract AF 19(628)-5111)
(AD-675635; TRG-05700; AFCRL-68-0361) Avail: CFSTI CSCL 20/5

A quantum theory of laser oscillation and a related theory of spontaneous emission in the presence of a prescribed classical field have been developed. Author (TAB)

N69-31342*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
INVESTIGATION OF THE ANGLE FLUCTUATION OF INCOMING LASER EMISSIONS IN THE NEAR-EARTH LAYER OF THE ATMOSPHERE [ISSLEDOVANIYE FLUKTUATSIY UGLOV PRIKHODA LAZERNOGO IZLUCHENIYA V PRIZEMNOM SLOYE ATMOSFERY]
B. D. Borisov et al Washington NASA Jul. 1969 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (Tomsk), no. 1, 1969 p 103–106
(Contract NASw-1692)
(NASA-TT-F-12380) Avail: CFSTI CSCL 20E

The angle fluctuations of an incoming laser beam over a path extending 1200 m are investigated experimentally; the dimensions of the aperture of the transmitting and receiving devices and the geometry of the beam were varied during the measurements. The results of the measurement are compared with those of a simultaneous examination of the angle fluctuations of the incoming radiation from a source of spherical waves. It is shown that the angles of approach of the laser emission are distributed according to a normal law. The dispersion of the angles of incoming laser emissions depends on the diameter of the receiving aperature in power of $-1/3$ and increases with a decrease of the angular span of the beam, becoming greater than the dispersion of angles of the incoming spherical wave. Author

N69-31343*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
METHOD AND APPARATUS FOR WAVELENGTH TUNING OF LIQUID LASERS
Gottfried T. Schappert, inventor (to NASA) Kenneth W. Billman, inventor (to NASA) and David C. Burnham, inventor (to NASA) Filed 16 May 1969 7 p
(NASA-Case-ERC-10187; US-Patent-Appl-SN-825253) Avail: CFSTI CSCL 20E

A method and an aparatus for wavelength tuning and for increasing the conversion efficiency of a liquid laser are described. The apparatus consists of a liquid cell containing the lasing liquid and the appropriate laser mirrors. The wavelength tuning is achieved by controlling the temperature of the cell. For this purpose, the liquid cell is enclosed in an oven or a heating tape to obtain temperatures above the ambient temperature; for operation below the ambient temperature, the cell is surrounded by a refrigerant. Possible applications of the method are in wavelength matching for selective excitation of molecules, in optical communications, in spectroscopic measurements, and in tunable optical sources by optical mixing. Conversely, temperature can be measured by measuring the wavelength; hence, the device can be used as a thermometer. NASA

N69-31684# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
DEGRADATION OF LASER OPTICAL SURFACES
T. L. Barber Mar. 1969 22 p refs
(AD-685855; ECOM-5237) Avail: CFSTI CSCL 20/5

Problems of optical surface degradation became apparent while measurements were being made with a laser. After examination, it was concluded that the defects fell into two categories - those caused by atmospheric dust and those resulting from the effects of cleaning solvents. A procedure is described which minimizes both of these problems. Author (TAB)

N69-31784# Georgetown Univ., Washington, D.C. Dept. of Physics.
THRESHOLD CALCULATIONS FOR SUPERCONDUCTING AND OTHER INFRARED LASERS

J. Bostock, W. D. Gregory, and L. Leopold 3 Jan. 1969 116 p refs
(Contract F44620-68-C-0017; Proj. THEMIS)
(AD-685795; AFOSR-69-0049TR) Avail: CFSTI CSCL 20/5

Stimulated radiative emission at the gap frequency in superconductors due to quasi-particle pairing is found to be more likely than stimulated phonon emission. Threshold conditions for lasing in normal-to-superconducting metal junctions were calculated. Criteria are established for determining the magnitude of current density in a superconductor which will destroy the energy gap. The range of several parameters for which radiation may be expected in injection type lasers is presented. A temperature dependent calculation of these lasing conditions for tantalum is also given. Experimental confirmation of the existence of stimulated emission in Al-Ta point contacts is presented. Author (TAB)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N69-30430 North Carolina Univ., Chapel Hill.
LOW TEMPERATURE RECOVERY OF ELECTRON IRRADIATED TUNGSTEN
Clyde Gordon Roberts (Ph.D. Thesis) 1968 47 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-1668

Pure (99.9995%) tungsten was used for a study to determine the threshold energy for damage and the temperature at which free lattice migration begins. The threshold energy for damage was found to be 47 ± 3 eV. An annealing peak at 22°K was found that is definitely due to long range migration. It was concluded that the minimum temperature for long range migration must be 22°K or less. Dissert. Abstr.

N69-30470 Northwestern Univ., Evanston, Ill.
THE SUPERCONDUCTING PROXIMITY EFFECT OF NIOBIUM
Charles John Kircher (Ph.D. Thesis) 1968 57 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-1866

In this investigation the proximity effect of niobium has been studied with a normal metal (copper) and a magnetic metal (nickel). The effect is studied in thin film sandwiches of Nb/Cu and Nb/Ni. The transition temperature of Nb/Cu and Nb/Ni sandwiches has been obtained as a function of Nb film thickness for thick overlayer films. The Nb/Cu data are in good agreement with both the DeGennes–Werthamer and the Moormann theories. The Nb/Ni data follow the form of the adjustable parameter theory proposed by Werthamer. However, Ni is found to have less effect on Nb than was reported for Pb; a value of the adjustable parameter $\beta = 7$ is obtained for Nb compared to the value $\beta = 43$ for Pb. Possible explanations of the observed behavior are discussed. Dissert. Abstr.

N69-30532*# Scripta Technica, Inc., Washington, D.C.
CORROSION RESISTANCE OF CONSTRUCTION MATERIALS TO SODIUM
V. V. Zotov et al *In its* Liquid Metals May 1969 p 300–317 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 11F

The chemical nature of oxygen in liquid sodium is analyzed and classified. Corrosion resistance of ferritic–pearlitic chromium steels as well as that of austenitic stainless steels is presented and discussed at various thermal and flow conditions. Alloys with a nickel base and refractory metals are grouped and classified. Author

N69-30535*# Scripta Technica, Inc., Washington, D.C.
EFFECT OF ADMIXTURES ON THE ELECTRIC RESISTANCE OF MOLTEN LITHIUM
M. N. Arnoldov et al *In its* Liquid Metals May 1969 p 336–339 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 11F

The effect of admixtures, such as nitrogen, oxygen, and hydrogen, on the electrical resistivity of liquid lithium is described. The temperature dependences of the admixture concentration and type of admixture are presented. Author

N69-30538*# Scripta Technica, Inc., Washington, D.C.
SOME PROBLEMS OF OPERATION AND DESIGN OF LIQUID-METAL LOOPS
A. V. Drobyshev et al *In its* Liquid Metals May 1969 p 360–367 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 11F

Operation and design problems of liquid metal loops operating with forced coolant circulation are described. Auxiliary systems, instrumentation, safety measures, equipment layout, and costs are included in the brief review. Author

N69-30545*# Scripta Technica, Inc., Washington, D.C.
TIME NEEDED FOR MELTING CYLINDRICAL [METAL] VOLUMES
V.M. Selivanov et al *In its* Liquid Metals May 1969 p 406–411 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 11F

Theoretical data and nomograms are presented for calculating the time needed for melting of metal cylinders, starting at a temperature below the metal melting temperature. Cases of constant temperature, constant heat flux, and constant heat transfer coefficient are considered (boundary conditions of the first, second and third kind, respectively). Author

N69-30548*# Scripta Technica, Inc., Washington, D.C.
CORROSION RESISTANCE AND TEMPERATURE LIMIT UTILIZATION OF CERTAIN CONSTRUCTION MATERIALS IN A SODIUM FLOW
In its Liquid Metals May 1969 p 446-447 (See N69-30507 17-33)
Avail: CFSTI CSCL 11F

Tables are presented on corrosion resistance to liquid metals of pearlitic chromium steels and nickel containing steels and alloys as well as refractory metals. Author

N69-30551 Delaware Univ., Newark.
THE EFFECT OF SURFACE ALLOYING ON THE PLASTIC DEFORMATION BEHAVIOR OF COPPER
William Richard Patterson (Ph.D. Thesis) 1968 194 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 68-17842

The effect of surface conditions on the mechanical properties and plastic deformation behavior of high-purity Cu single crystals was investigated by creating an alloyed surface region having elastic properties and lattice parameter both greater and less than that of Cu. Thin-films of Ni, Au and Ag were variously evaporated onto the Cu crystal substrate and the composite given an abbreviated diffusion-anneal in ultra-high vacuum, resulting in a surface-alloyed region extending only about 4000–20,000 Å into the crystal. The concentration gradient profile was controlled by the appropriate diffusion constants and the film thickness deposited. The mechanical properties and plastic deformation behavior were determined by room-temperature tensile testing, and the corresponding dislocation arrangements in the surface region were examined by transmission electron microscopy. The effectiveness of these contributions to dislocation interaction in the alloyed surface region was evaluated. Dissert. Abstr.

N69-30690 Minnesota Univ., Minneapolis.
APPLICATION OF TRANSPORT PHENOMENA TO MINERAL DRESSING
Fernando Jorge Concha (Ph.D. Thesis) 1968 274 p
Avail: Univ. Microfilms: HC $12.40/Microfilm $3.55 Order No. 68-17667

With the current trend toward fundamental approaches to engineering it is not surprising that more and more such disciplines have become of interest to engineers in common. Thus, relatively recently, the field of transport phenomena as a distinct engineering subject was adopted by both chemical and mechanical engineering. The study of all phenomena involving the transport of momentum, energy and mass has simplified and unified the study of operations involving fluid mechanics, and of mass and heat transfer. It is the purpose of this thesis to review and develop the fundamental concepts of transport phenomena that are relevant to unit operations in mineral dressing. To illustrate the power of these concepts the basic differential equations describing transport phenomena are used to construct mathematical models of several of these unit operations, or of parts of them. Dissert. Abstr.

N69-30730 North Carolina Univ., Chapel Hill.
RECOVERY OF PURE AND ALLOYED ALUMINUM IN STAGES AFTER 2 AND 3 MeV ELECTRON IRRADIATION
Philip Boardman Peters (Ph.D. Thesis) 1968 121 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-1660

Pure (99.9999%) and dilutely alloyed samples of aluminum were irradiated at temperatures below the conclusion of Stage 1 and the recovery in the region 60° to 300°K was studied. Impurities in the samples dominate the recovery through Stage 2 and into Stage 3, with the possibility of an intrinsic process occurring in the vicinity of 75°K in both the pure aluminum and the alloys. The addition of 0.3 atomic percent of Zn, Cu and Ge is found to influence the recovery in Stage 3, as well as Stage 2. A model in which single vacancies migrate to clusters of interstitials, which were formed during the preceding stages of recovery, appears to best account for the Stage 3 recovery of pure aluminum. Dissert. Abstr.

N69-30733 Stanford Univ., Calif.
EFFECT OF NONMETALLIC DISPERSIONS ON THE MECHANICAL BEHAVIOR OF BERYLLIUM
John William Moberly (Ph.D. Thesis) 1968 108 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-264

The research described was undertaken to determine the effect of various nonmetallic dispersions on the mechanical behavior of beryllium-base composites. The composite systems chosen for study were: beryllium–beryllium oxide, beryllium–beryllium carbide, beryllium–silicon, and beryllium–tungsten beryllide. These two-phase composites were prepared by powder metallurgical techniques chosen so as to achieve uniform dispersions of the second phase within the beryllium matrix. Microstructural analysis showed that the dispersed particles limit the beryllium grain size. Beryllium oxide is the most effective. However, in all composites the second phase particles were always present in the beryllium grain boundaries. This contributes to the strengthening but also leads to very low ductility prior to fracture. There was no indication that beryllium composites with this microstructure would lead to increased low temperature ductility in polycrystalline beryllium. Dissert. Abstr.

N69-30738 Denver Univ., Colo.
A STUDY OF TERNARY HYDRIDE PHASES FORMED BY REACTION OF LiH AND SELECTED METALS
Frank Chiang Chang (Ph.D. Thesis) 1968 59 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-17837

Nineteen metallic elements were reacted with lithium hydride to determine whether or not ternary hydride phases similar to Li_4RhH_4 and Li_4RhH_5 exist for other metal-lithium-hydrogen systems. Reactions were carried out either under vacuum or under a known pressure of hydrogen (up to one atmosphere) in a Sieverts apparatus. The starting material in most cases was 4 to 1 molar ratio mixture of LiH and the metal in powder form. The maximum temperature employed was 800°C. Under these experimental conditions no reaction was observed between LiH and the metals Fe, Co, Ni, Cu, Mo, Ru, W, Re, and Os. Reactions were observed for Al, Nb, Ag, Ce, Au, Pb, and Th. The products obtained in these cases were nonhomogeneous and in low yield. There was some evidence that Al, Nb, Ce, and Th formed binary hydrides. The metals Ir, Pd, and Pt formed both ternary hydrides and intermetallic compounds. Dissert. Abstr.

N69-30764 Northwestern Univ., Evanston, Ill.
INITIAL SOLID STATE SINTERING OF HEMATITE
John Stuart Smart, III (Ph.D. Thesis) 1968 142 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-1943

A new method for the analysis of all mechanisms operating during solid state sintering has been developed based upon separation of components by simultaneous measurement of shrinkage and neck growth. This method has been successfully applied to the sintering of high purity (99.999%) hematite spheres to show that sintering occurs by simultaneous grain boundary and surface diffusion. Least squares values for the diffusion coefficients controlling the sintering rate are presented for the temperature range 900–1300°C. At 1100°C and above, oxygen vacancies were the rate controlling species, while at 1000°C and below, iron vacancies are rate controlling. The activation energy for the densification process is shown not to represent any one process. Dissert. Abstr.

N69-30900# Boeing Co., Renton, Wash. Commercial Airplane Div.
INCREASING THE TOUGHNESS OF AFC 77 BY CONTROL OF RETAINED AUSTENITE CONTENT, AUSFORMING, AND STRAIN AGING
Donald Webster Aug. 1968 51 p refs
(AD-675868; D6-23448) Avail: CFSTI CSCL 11/6

A high strength martensitic stainless steel, AFC 77, suffers from low fracture toughness in its highest strength conditions produced by tempering in the range 800° to 1100°F. Three methods

of improving toughness without loss of strength have been utilized to overcome this: control of retained austenite content, strain aging, and ausforming. Author (TAB)

N69-30905 Houston Univ., Tex.

AN INVESTIGATION OF THE ABSORPTION AND THE DIFFUSION OF GASES IN PALLADIUM METAL AND ZIRCONIUM-IRON ALLOY USING FLUORESCENT AND MOSSBAUER TECHNIQUES

Charles Samuel De John (Ph.D. Thesis) 1968 127 p

Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-770

This work investigated the absorption and the diffusion of gases in palladium metal and zirconium-iron alloy using fluorescent and Mossbauer techniques. A hydrogen gas discharge experiment demonstrated silver activated ZnS and ZnCdS lumophors were caused to luminesce by the 4.76 ev of energy released by each pair of hydrogen atoms recombining at the lumophor's surface. The lumophors were used to search for atomic hydrogen in a hydrogen gas stream after the gas had diffused through a palladium tube. The tube was heated from 90 to 500°C and the pressure on the entrance side varied from one to one and one-half atmospheres. No luminescence was observed indicating that the maximum fraction of atomic hydrogen present was 7.6×10^{-9}. The conclusion is that hydrogen desorbed as molecules from the metal surface. Dissert. Abstr.

N69-30908# Centre National de la Recherche Scientifique, Paris (France).

DEVELOPMENT WORK ON STRESS-CRACKING CORROSION OF STAINLESS STEELS [MISE AU POINT AU SUJET DE LA CORROSION SOUS TENSION DES ACIERS INOXYDABLES]

J. Montuelle, M. Cunha Belo, Ph. Berge (EURATOM), and D. Colin Brussels EURATOM 1969 23 p refs In FRENCH; ENGLISH summary

(Contract EURATOM-059-65-1-TEEF)

(EUR-4000.f; EURAEC-2064) Avail: CFSTI

Cracking in stainless steels under mechanical stress in boiling magnesium chloride is due to the prior formation of a thin film of passivating oxide; it was possible to establish this point mainly by means of electron microscopy and electrochemical techniques. The role of certain factors relating to the corrosive medium was demonstrated. By means of the study of high-purity alloys, it was possible to determine that immunity to stress corrosion of stainless steels with austeno-martensitic structure could be achieved by a purely electrochemical technique. Author

N69-30924# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.

MECHANICAL PROPERTIES OF Al-Al_2O_3 COMPOSITES. PART 1: SAP-ISML

D. J. Boerman, M. Grin, and M. Veaux Brussels 1969 218 p refs

(EUR-4074.f-Pt-1) Avail: CFSTI

This report treats principally the mechanical properties (to 600°C) of the four SAP-grades (Sintered Aluminum Powder) fabricated by ISML (Istituto Sperimentale Metalli Leggeri, Novara – Italy). Most of the results, described in this report, were realized between 1960 and 1967 in three research centers: JRC-Ispra, ISML, Novara, and Battelle Institut, Frankfurt. The fabrication process of the semifinished products (bars and tubes) and finished products (canning tubes and pressure tubes) are presented. The mechanical properties of the SAP-alloys in general consists of: (1) the results of tension, compression, creep and fatigue tests at various temperatures; (2) diagrams of the mechanical properties as a function of temperature or percentage of aluminium oxide. The experimental conditions and some physical properties of SAP are described. Author

N69-30925# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.

MECHANICAL PROPERTIES OF Al-Al_2O_3 COMPOSITES. PART 2: FRITTOXAL

D. J. Boerman, M. Grin, and M. Veaux Brussels 1969 65 p refs

(EUR-4074-e-Pt-2) Avail: CFSTI

This report, based in part on already published data, deals with the main mechanical properties of Frittoxal which is the trade name of an aluminium-alumina composite produced by the Trefileries et Laminoirs du Havre (now Tréfimétaux, Paris, France). Frittoxal is a product which differs from the Al-Al_2O_3 composites, known as SAP, mainly by the fact that the starting material is not really a powder of round particles but a powder composed of aluminum flakes. The manufacturing process of finished products is explained and the conventional symbols for the identification of powders are the mechanical properties of finished products obtained from standard grades of Frittoxal are described. Finally the influence of starting powder and of thermal treatments is analyzed. Author

N69-30931# Defence Research Board, Ottawa (Ontario). Defence Scientific Information Service.

EFFECT OF ELECTRICAL CURRENT ON CAVITATION EROSION AND ON THE MICROSCOPIC SUBSTRUCTURE OF METAL

A. F. Derendovski et al May 1969 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 183, no. 6, 1968 p 1292–1294

(T-519-R) Avail: CFSTI

The process of corrosion incidence and the effectiveness of electrical protective methods were investigated by tests conducted in an ultrasonic cavitating field at 20 kHz. The distinctive feature of the test method was that samples were introduced into the cavitation zone without being fastened to the concentrating head of the magnetostrictive emitter and were not subjected to oscillatory motion, as in the case of erosion tests in a stressed sample. It was found that the anodic breakdown of metals is markedly increased under the influence of cavitation, while the microstructure is little altered. The possibility of intensifying specified technological processes by simultanious action of cavitation and an anodic current was therefore suggested. A.C.R.

N69-30944*# Boeing Scientific Research Labs., Seattle, Wash. Solid State Physics Lab.

STRESS CORROSION CRACKING OF TITANIUM ALLOYS: SCC OF ALUMINUM ALLOYS, POLARIZATION OF TITANIUM ALLOYS IN HYDROGEN CHLORIDE AND CORRELATION OF TITANIUM AND ALUMINUM SCC BEHAVIOR Quarterly Progress Report, 1 Oct. 1968–31 Mar. 1969

T. R. Beck, M. J. Blackburn, and M. O. Speidel 31 Mar. 1969 105 p refs

(Contract NAS7-489)

(NASA-CR-103236; QPR-11) Avail: CFSTI CSCL 11F

Work on titanium alloys shows basic similarities in all stress corrosion cracking (SCC) susceptible alloy systems regarding the relation of velocity to potential, and the transcrystalline cleavage-like-fracture path and morphology which is independent of crystal structure. The titanium–manganese system shows a

transgranular SCC threshold at 10% Mn compared to 5% Al in the titanium–aluminum system. Investigations on hydrogen embrittlement showed very different fracture path morphology and velocity for hydrogen embrittlement and SCC in titanium–manganese alloys. Aluminum alloys revealed many striking similarities to titanium alloys in SCC behavior. Both show a mass transport controlled velocity with small stress dependence and under selected conditions, a lower velocity, strongly stress dependent. The relationship of velocity to potential, concentration of halide ions, and viscosity of glycerol-water solutions is similar and appears to be consistent with the electrochemical mass-transport-kinetic model previously developed for titanium. Analysis of the stress suggests an electrochemical kinetics controlled reaction at the crack tip. Author

N69-30987*# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.

CHLORINE GAS AND FLUORIDE ION IN HOT-SALT STRESS CORROSION CRACKING OF TITANIUM-ALUMINUM ALLOYS

Robert S. Ondrejcin Mar. 1969 21 p refs Prepared for AEC (NASA Order R-124; Contract AT (07-2)-1)
(NASA-CR-103257; DP(NASA)-1179) Avail: CFSTI CSCL 11F

In hot-salt stress corrosion cracking of titanium, chlorine is not the cracking agent at the nominal cracking temperature of 290°C. Above 650°C, however, chlorine does take part in corrosion of titanium. In the cracking process, pyrohydrolytic formation of a hydrogen halide rather than chlorine is indicated. In the salt-titanium reaction at 260 or 400°C, chlorine was not found by mass spectrometry, nor was chlorine observed at 340 or 650°C by ultraviolet spectroscopy. At 650°C, the ratio of HCl/Cl_2 was greater than 105/1, based on the limit of detection by ultraviolet spectroscopy. Sodium fluoride does not cause hot-salt titanium stress corrosion cracking as do the other sodium halide salts because NaF absorbs much less water, and NaF-coated specimens do not absorb hydrogen generated during corrosion reactions. Author

N69-30995# European Atomic Energy Community, Ispra (Italy).

DECANNING OF UO SUB 2 Pu O SUB 2/INOX FUELS BY LIQUID METALS. PART 1: SEARCH FOR A SOLVANT ALLOY [DEGAINAGE DES COMBUSTIBLES UO SUB 2 PUO SUB 2/INOX PAR LES METAUX LIQUIDES. PARTIE 1: RECHERCHE DUN ALLIAGE SOLVANT]

M. Payrissat and J.G. Wurm Brussels 1969 44 p refs In FRENCH; ENGLISH Summary
(EUR-4229.f-Pt-1) Avail: CFSTI

A new decanning process by liquid metals is presented. The aim of the study is to find a solvent alloy, able to dissolve the stainless steel sheaths at temperatures below 1000°C. The experimental study has allowed to point out the excellent dissolving properties of a Sb–Cu alloy for a large variety of stainless steels. Various dissolution curves summarize the results. Author

N69-31065*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CORROSION IN A COBALT ALLOY, TWO-PHASE MERCURY LOOP

Alex Vary, Coulson M. Scheuermann, Louis Rosenblum, and Warren H. Lowdermilk Washington Jul. 1969 36 p refs
(NASA-TN-D-5326) Avail: CFSTI CSCL 11F

A two-phase mercury corrosion loop was operated for 1147 hr at a peak liquid temperature of 1075° F (858 K). The loop was constructed of the cobalt-base alloy HS-25 (L-605). The maximum corrosion occurred in the boiler inlet near the point where two-phase flow began and the liquid temperature peaked. The loop results were compared with corrosion capsule tests and other loops of the same alloy. The corrosion markedly exceeded that found in either the reflux capsules or flow-velocity loops operated at the same temperature. Author

N69-31124 California Inst. of Tech., Pasadena.

MAGNETIC MOMENTS IN AMORPHOUS PALLADIUM-COBALT-SILICON ALLOYS

Martin Eric Weiner (Ph.D. Thesis) 1969 78 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-541

The magnetic moments of amorphous ternary alloys in various atomic concentrations were measured between 1.8° and 300°K and in magnetic fields up to 8.35 kOe. The alloys were obtained by rapid quenching of a liquid droplet, and their structures were analyzed by X-ray diffraction. The measurements were made in a null-coil pendulum magnetometer, in which the temperature could be varied continuously without immersing the sample in a cryogenic liquid. The alloys containing 9 at .% Co or less obeyed Curie's Law over certain temperature ranges and had negligible permanent moments at room temperature. Those containing 10 and 11 at .% Co followed Curie's Law only above 200°K and had significant permanent moments at room temperature. For all alloys, the moments calculated from Curie's Law were too high to be accounted for by the moments of individual Co atoms. To explain these findings, a model based on the existence of superparamagnetic clustering was proposed. The cluster sizes calculated from the model were then analyzed for consistency with the onset of ferromagnetism for various concentrations. Dissert. Abstr.

N69-31166# National Lead Co. of Ohio, Cincinnati.

EFFECTS OF POURING ORIFICE AND MOLD BOTTOM CONFIGURATION ON INGOT SURFACES

G. A. Graman and D. E. Kettler Mar. 1969 19 p refs
(Contract AT(30-1)-1156)
(NLCO-1026) Avail: CFSTI

A laboratory-scale study was conducted to determine the effect of orifice configuration on the integrity of a pour stream simulating molten uranium. The effect of the mold bottom shape on the initial metal splash was also investigated. The apparatus used consisted of a 3/8-scale acrylic plastic model of the bottom-pouring crucible and mold used in production. Mercury was used as the fluid in these studies because many of its physical properties are similar to those of molten uranium. The changes in the pour stream and in the initial metal splash were recorded with a motion picture camera. It was found that pour plugs having an orifice with tapered sidewalls and a rounded edge at the top produced the most desirable pour stream. Mold bottoms which were flat or which approached flatness with no abrupt change in contour minimized metal splash. Author (NSA)

N69-31281# Argonne National Lab., Ill.

REDUCTION OF URANIUM DIOXIDE IN MOLTEN SALT-METAL SYSTEMS

D.A. Wenz, R.D. Wolson, and I. Johnson Nov. 1968 17 p refs
(Contract W-31-109-eng-38)
(ANL-7463) Avail: CFSTI

A study was made of the reducibility of sintered UO_2 powder and pellets in agitated, immiscible molten salt-metal alloy systems. Systems consisting of a salt mixture having less than about 25 mol% $MgCl_2$ and the alloy Mg–44 at.% Cu proved to be unsatisfactory media for UO_2 reductions. The use of salts containing about 50 mol% $MgCl_2$ with the above alloy allowed good reductions of UO_2 powder, but reductions of larger particles

of UO_2 were too slow for process purposes. These results suggest an inhibition of reduction by the insoluble MgO reduction product. Utilization of $CaCl_2$ salt/Cu–Mg–Ca alloy reduction system, where the CaO reduction product dissolves in the salt phase, gave rapid, complete reduction of even UO_2 pellets. The experimental data suggest that UO_2 reduction proceeds through reaction of UO_2 at the solid-particle surface with magnesium or calcium metal dissolved in the salt phase (as the species Mg^{2+}_2 or Ca^{2+}_2).
Author

N69-31292# Oak Ridge National Lab., Tenn. Gaseous Diffusion Plant.
PHOSPHORUS TRIFLUORIDE CYLINDER FAILURE
R. L. Ritter, F. N. Beneay, T. A. Nolan, P. W. Pickrell, and K. T. Ziehlke 3 Apr. 1969 12 p refs
(Contract W-7405-eng-26)
(K-1772) Avail: CFSTI

A mild steel, high pressure gas cylinder containing phosphorus trifluoride failed in storage about 15 months after filling. Microscopic and metallographic examinations of the failed cylinder have shown the failure to have probably been the result of stress corrosion of the mild steel. The similarity to failure of carbon monoxide gas cylinders is pointed out. Specific recommendations for future use and storage of phosphorus trifluoride cylinders are presented. These include among others limiting the filling pressure to less than 1000 psia and a maximum period of storage not to exceed one year.
Author (NSA)

N69-31301*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
SURFACE TENSION OF METALS [POVERKHNOSTNOYE NATYAZHENIYE METALLOV I SPLAVOV]
A.M. Korolkov et al Washington NASA Jul. 1969 16 p refs Transl. into ENGLISH From Issled. Splavov Tsvetn. Metal. Akad. Nauk SSSR, Inst. Met. (Moscow), No. 2, 1960 p 122-134
(Contract NASw-1692)
(NASA-TT-F-12407) Avail: CFSTI CSCL 11F

Experiments involving surface tension of zinc and aluminum binary and ternary alloys are described. The authors conclude that the addition of a surface-active admixture, whose atomic volume is greater than that of the solvent, will reduce the surface tension of the alloys.
Author

N69-31306# Naval Research Lab., Washington, D.C. Metallurgy Div.
RATIO ANALYSIS DIAGRAM INTERPRETATIONS OF THE FRACTURE TOUGHNESS CHARACTERISTICS OF MARAGING STEEL WELDS IN THE RANGE FROM 150 TO 200 ksi YIELD STRENGTH Final Report
P. P. Puzak and E. A. Lange 26 Mar. 1969 12 p refs
(AD-686376; NRL-6878) Avail: CFSTI CSCL 11/6

The ratio analysis diagram (RAD), which is a graphical method by which the fracture toughness of a material may be commonly indexed by various energy scales, was used to characterize the fracture behavior of maraging steel weld metals in the yield strength range from 150 to 200 ksi. Dynamic tear (DT) tests for indexing to the RAD were conducted for four wire compositions. The predicted structural performance ranged from fracture initiation requiring large flaws and plastic instability for 160-ksi yield strength material, to fracture initiation requiring only flaws in the range of tenths of an inch and elastic stresses for 190-ksi yield strength material.
Author (TAB)

N69-31378# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
PROTECTION OF URANIUM BY CLADDING
P. Beque, P. Koch, R. Dominget, and R. Darras 1968 57 p refs In FRENCH Presented at the 50th Anniv. of the Soc. of Ind. Chem., Paris, 27 May 1968
(CEA-CONF-1053; CONF-680539-2) Avail: AEC Depository Libraries

Studies were made on the possibilities of inhibiting or limiting the oxidation of uranium by CO_2 at high temperatures by means of protective cladding. Success is usually obtained with the composition of the surface film based on intermetallic compounds or solid solutions of uranium with aluminum, zirconium, copper, niobium, nickel, or chromium according to various techniques described. The processes of direct diffusion starting with a thin film or foil, evaporation under vacuum, or immersion in molten baths of suitable composition appear to be particularly satisfactory. The most suitable conditions for using these claddings for the purpose of protection are in CO_2 at 450 to 500°C. Only the claddings with aluminum base or of zirconium proved to be entirely satisfactory, for they are capable of reducing the oxidation of uranium under the conditions considered, and to inhibit the liberation of powdered oxide.
Author (NSA)

N69-31523# Aerojet-General Corp., Sacramento, Calif. Nuclear Div.
XE FLAME SPRAY CAPABILITY TESTS FOR TITANIUM, HASTELLOY, 347 STAINLESS STEEL, AND 6061 T-6 ALUMINUM
H. A. Fox, Jr. Nov. 1968 8 p
(Contract SNP-1)
(RN-TM-301) Avail: CFSTI

Tests were made to determine the interface bond integrity between test material and flame sprayed aluminum. The materials considered were 347 stainless steel, Hastelloy C, and 304 stainless steel that are used for the turbine inlet line (TIL), pump discharge line (PDL), and diluent line (DL) respectively. Because of the similarity of 347 and 304 stainless steels, only 347 was tested. Type 6AL-4V titanium was also included in this test since it is a primary candidate for the NERVA pressure vessel. Additional tests were also conducted on 6061 T-6 aluminum. Since sheathed cables must be mechanically attached to surfaces in a manner which will prevent movement during the subsequent grit blasting and flame spraying operations, additional tests were made to determine a suitable method of cable attachment to these materials.
Author (NSA)

N69-31553# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
EROSION-CORROSION OF ALUMINUM IN HIGH VELOCITY WATER
D. A. Jones [1969] 7 p Presented at 25th Ann. Conf. of the Natl. Assoc. of Corrosion Engr.
(Contract AT(45-1)-1830)
(BNWL-SA-2080; CONF-690304-2) Avail: CFSTI

Experiments were performed to examine the effects of high temperature high velocity water on the corrosion and erosion of aluminum specimens. This simulates conditions for aluminum clad reactor fuel elements exposed to cooling water. The construction and operation of the laboratory apparatus is described. A single pass of high velocity hot water was used. In situ electro-chemical measurements were made. It is suggested that erosion occurs primarily in the oxide film, thinning the film and thereby accelerating corrosion. This process occurs more rapidly at high temperatures and with an increasing degree of solution impurities. Deep surface grooving is assumed to be the result of hydraulic action on existing surface imperfections.
NSA

N69-31558# Army Materials and Mechanics Research Center, Watertown, Mass.
FRACTURE SURFACE TOPOGRAPHY AND TOUGHNESS OF 4340 STEEL
Frank L. Carr and Frank R. Larson Feb. 1969 21 p refs
(AD-685836; AMMRC-TR-69-03) Avail: CFSTI CSCL 11/6

AISI 4340 steel was heat treated to eight strength levels by tempering groups of specimens at intervals of 100 F between 500 F and 1200 F. Tension, notch tension, and Charpy V-notch impact specimens were machined from these materials and tested over a range of temperatures between that of liquid nitrogen and 400 F. The fracture of each specimen was examined at low magnification and each zone of fracture surface configuration was measured. When plotted as a function of testing temperature, these measurements resulted in transitional curves for all three types of specimens. Author (TAB)

N69-31618*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
DEVELOPMENT OF A DISPERSION STRENGTHENED CHROMIUM ALLOY
W. A. Bryant and S. J. Orbon 15 Jan. 1969 67 p refs
(Contract NAS3-10487)
(NASA-CR-72553; WANL-PR-GG-001) Avail: CFSTI CSCL 11F

A ZrO_2-chromium alloy was produced. Submicron ZrO_2-coated chromium powder was prepared by thermally decomposing $Zr(OR')_4$ (zirconium tetratertiary butoxide) onto gas phase nucleated chromium particles. Powder particle size could be controlled to within a few hundred angstroms. The as-produced powder was contaminated with both excessive amounts of carbon and oxygen. However, carbon content was reduced to <100 ppm by hydrogen sintering. The powder product was consolidated by cold pressing plus extrusion. The as-extruded product was dense and contained a uniform ZrO_2 dispersion. However, the dispersion was unstable at high temperatures. This is attributed to the combination of the inherent relative instability of the ZrO_2 with respect to the chromium matrix, plus the excessive oxygen contamination. The inability of vendors to synthesize $Th(OR')_4$ prevented development of a ThO_2-chromium alloy. Author

N69-31717# Los Alamos Scientific Lab., N. Mex.
GENERATION OF HIGH-PRESSURE ISOTHERMS FOR LIQUID AND SOLID SODIUM
T. R. Neal 18 Nov. 1968 14 p refs
(Contract W-7405-eng-36)
(LA-4050) Avail: CFSTI

The objective of this report is to construct isotherms of sodium by calculating the isothermal compressibility. A simple form for the electron-ion pseudopotential allows the effective ion–ion interaction to be readily determined. In the case of liquid sodium, this determination is used in turn to construct a hard sphere model for the structure factor. A model of liquid sodium which disregards certain electron–electron effects is then examined to see where those effects become important. Finally, a simple calculation for the compressibility with those effects included is used to generate isotherms for solid and liquid sodium. The isotherms seem to agree reasonably well in the pressure region where experimental data are available. Author (NSA)

N69-31719# Oak Ridge National Lab., Tenn.
COMPATIBILITY OF HASTELLOY N AND CROLOY 9M WITH SODIUM FLUOROBORATE-SODIUM FLUORIDE-POTASSIUM FLUOROBORATE (90-4-6 MOLE PERCENT) FLUOROBORATE SALT
J. W. Koger and A. P. Litman Apr. 1969 40 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2490) Avail: CFSTI

The compatibility of a relatively impure (>3000 ppM impurities) fluoroborate salt, $NaBF_4$–NaF–KBF_4 (90-4-6 mole %), with Hastelloy N and Croloy 9M was evaluated in natural circulation loops operating at a maximum temperature of 606°C with a temperature difference of 145°C. The Croloy 9M loop (NCL-12) was completely plugged after 1440 hr of operation and the Hastelloy N loop (NCL-10) was three-quarters plugged after 8760 hr (one year) of operation. All major alloying elements of the container materials mass transferred during operation as the result of nonselective attack by virtue of the initial oxygen and water contamination of the salt. Saturation concentrations of 700 ppM Fe and 470 ppM Cr were determined for the fluoroborate salt at 460°C. The mechanism of corrosion of the system is as follows. Initially, metal fluoride compounds that are soluble in the salt are formed in the hot leg. The reverse reaction occurs in the cold leg and causes the metal to deposit and to diffuse into the cold leg. Author (NSA)

N69-31720# Aerojet-General Corp., San Ramon, Calif. Nuclear Div.
EVALUATION STUDY OF HASTELLOY X AS A NUCLEAR CLADDING. VOLUME 2: MECHANICAL PROPERTIES INVESTIGATIONS Final Technical Report
R. M. Baciarelli and G. W. Titus Aug. 1968 159 p refs
(Contract AT(04-3)-368)
(AGN-8289-Vol-2) Avail: CFSTI

Centrifugal creep tests were performed at 1300° and 1400°F in argon and 1800°F in air, and the results were compared with data developed in single-specimen tensile creep tests performed at the same conditions. The theory of centrifugal creep testing is presented together with a computer method and for data reduction which converts specimen deflection data, obtained in centrifugal testing to uniaxial creep data. It was also observed that the differences between centrifugal and tensile data are minimal when the tests are performed at lower temperatures in inert atmosphere. A low-cobalt content heat of Hastelloy X was found to be most creep resistant when tested at 1300°F but least creep resistant when tested at 1400 and 1800°F. Specimens of two heats tested had different tensile creep curves when tested at 1800°F; these were attributed to differences in the work hardening and stress recovery mechanisms. The creep rates of specimens of all the heats tested became essentially the same after long exposure at 1300 and 1400°F. NSA

N69-31738# National Lead Co. of Ohio, Cincinnati.
A CONCEPTUAL CELL FOR ELECTROWINDING LIQUID URANIUM
C.E. Polson, T.R. Kato, J.H. Trapp, D.G. Kesterke, and R.A. Rapp 1968 25 p refs Presented at Electromet. and Elec. Furnace Symp., Cleveland
(NLCO-1033; CONF-681204-2) Avail: CFSTI

A production-scale cell is proposed for electrowinning liquid uranium from uranium dioxide feed in a molten flouride electrolyte. The design is based on the development work of several investigators. Features of the design include a vertical cathode, a terraced, electrically floating hearth, isolation of the metal pool from the oxide feed, and provision for rapid removal of the molten metal. Problems of other researchers in achieving high current efficiencies and the importance in the cell design of feeding sufficient oxides to the anode area and of maintaining ample metal-to-anode-spacing are analyzed. Author (NSA)

N69-31760# Babcock and Wilcox Co., Alliance, Ohio. Research Center.
CORROSION AND HYDRIDING OF ZIRCALOY. TASK 1: CORROSION AND HYDRIDING OF ZIRCALOY UNDER HEAT TRANSFER CONDITIONS Final Report

M. M. Rubright, D. W. Koch, and K. M. Ferguson Jan. 1969 149 p refs
(Contract AT(30-1)-3765)
(BAW-3765-7; EURAEC-2016) Avail: CFSTI

The corrosion and hydriding characteristics of Zircaloy-4 under operating conditions simulating those expected in advanced water reactors were determined. A number of 0.420-inch-diameter tubular Zircaloy-4 and Zircaloy-2 specimens were exposed to 640°F water in a high pressure dynamic loop. The coolant pressure was 2250 psi and velocity past the specimen was about 13 fps. Special heaters inserted in the specimens gave surface heat fluxes of 600,000 Btu/hr-ft^2 over a 6-inch section. It was found that the corrosion rates of Zircaloy under heat transfer and isothermal conditions are essentially the same and that more hydrogen is absorbed under heat transfer conditions than under isothermal conditions. The presence of dissolved hydrogen in the coolant in concentrations of 20 to 40 cc per liter does not affect the hydrogen absorption rate and the presence of chemical shim control solids do not affect the corrosion rate or the hydrogen absorption rate under short-term conditions. NSA

N69-31771# Cornell Univ., Ithaca, N.Y. Materials Science Center.
ALLOY SOFTENING IN THE IRON-NICKEL SYSTEM
Robert Paul Gamble (M.S. Thesis) Feb. 1969 118 p refs
(REPT-1074) Avail: Issuing Activity

The phenomenon of alloy softening is redefined as a lowering of the temperature dependence of the thermal component of stress for yield or flow over some range of temperature on addition of solute to bcc transition metals. The occurrence of alloy softening on addition of small amounts of various substitutional or interstitial solutes to certain bcc transition metals is documented. The mechanisms proposed to explain substitutional alloy softening are discussed; it is concluded that a solute-induced decrease in the Peierls energy barrier is the most probable cause. The Dorn-Rajnak formulation of the Peierls mechanism and the method of experimental verification are discussed. Three iron-base alloys were used in the investigation: Fe, Fe-1 without Ni, and Fe-2 without Ni. Interstitial impurities were gettered with a titanium addition to the melt. Mechanical properties were determined by performing tensile tests on each alloy over the temperature range 77° to 432°K. Activation parameters were obtained from data gathered during strain rate change experiments. Author

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N69-30425# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE QUANTITATIVE DETERMINATION OF BIS-PHENOL ANTIOXIDANT ADDITIVES IN PETROLEUM OILS BY INFRARED SPECTROSCOPY
A. A. Kadushin et al Nov. 1968 11 p refs Transl. into ENGLISH from Sb. Prac Chem. Fak. SVST (Bratislava), 1966 p 195–200
(AD-684832; FTD-HT-23-629-68) Avail: CFSTI CSCL 11/8

For the determining bis-phenolic antioxidants in petroleum oils by infrared spectroscopy, the bands corresponding to the hydroxyle groups are convenient as anslytical bands, i.e., 3498/cm for 2,2-methylene-bis (4-methyl-6-tert-butylphenol), 3435/cm for 2,2-di-thio-bis (4-methyl-6-tert-butylphenol) and 3410/cm for 2,2-thio-bis (4-methyl-6-tert-butylphenol). From the intensity at the maximum of the absorption bands, found by the basic line method, the antioxidants may be determined with an average relative error of 1.3 percent for concentrations of 0.05 up to 1 percent of weight in the oils. Author (TAB)

N69-30549*# Boeing Co., Seattle, Wash. Aerospace Group.
STUDY OF SPACE ENVIRONMENT EFFECTS ON THERMAL CONTROL COATINGS: DEPENDENCE OF THERMAL CONTROL COATING DEGRADATION UPON ELECTRON ENERGY Final Report
Lawrence B. Fogdall and Sheridan S. Cannaday May 1969 125 p refs
(Contract NAS5-11164)
(NASA-CR-103205; D2-126114-1) Avail: CFSTI CSCL 11C

The effects of 20-keV, 50-keV, and 80-keV electrons on the reflectance of selected types of thermal control coatings and surfaces were studied and compared. Both diffuse and specular materials of current interest for space application were exposed in the dark in a 10^{-8} torr vacuum to electron fluences as great as 10^{16} electrons/cm^2. The types of coatings and surfaces tested included diffuse white paints, a metallic gray paint, Kapton, metallized Teflon and lacquer, aluminum, and overcoated aluminum. The hemispherical spectral reflectance of each test specimen was measured in vacuum before and after exposure, using an integrating sphere, a monochromator, and a continuous wavelength scan technique between 0.25 and 2.5 microns. Plots of reflectance or reflectance changes as a function of wavelength were obtained by computer-processing of test data, and are presented. It was concluded that reflectance degradation in most materials studied is strongly dependent upon electron energy. Relative effectiveness of 20-, 50-, and 80-keV electrons for causing spectral reflectance degradation was determined for those coatings showing sufficient damage. Author

N69-30735 Illinois Univ., Urbana.
CONTROLLABLE STATES OF ELASTIC HEAT CONDUCTORS
Henry Joseph Petroski (Ph.D. Thesis) 1968 51 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No 69-1408

This thesis determines steady controllable states of elastic heat conductors which are in mechanical equilibrium. Both extrinsic heat supply and mechanical body force are assumed absent. The heat flux is assumed to depend upon the deformation gradient and the temperature gradient, while the stress is taken to be a function of the deformation gradient and the temperature. All materials are homogeneous and isotropic. The results are summarized in three theorems: (1) For compressible materials the only controllable state is a homogeneous deformation coupled with a uniform temperature field. (2) For incompressible materials there are no non-trivial controllable states when the principal strain invariants are not all constant. (3) For incompressible materials there exist non-trivial controllable states when all principal strain invariants are constant. Dissert. Abstr

N69-30682# Army Materials and Mechanics Research Center, Watertown, Mass.
IRREVERSIBLE DIMENSIONAL CHANGES AND THE INITIAL GRAPHITIZATION KINETICS IN ANNEALED PYROLYTIC GRAPHITE
R. Nathan Katz and Frederick P. Meyer Jan. 1969 12 p refs
(AD-684912; AMMRC-TR-69-01) Avail: CFSTI CSCL 11/2

The irreversible dimensional changes in the a and c directions in pyrolytic graphite were studied as a function of time (up to 4 hours) and temperature (2500 to 2800 C). The change in the c lattice parameter was also studied. Activation energies for the initial stages of dewrinkling and graphitization have been obtained. Author (TAB)

N69-30909# Aerospace Corp., El Segundo, Calif. Lab. Operations.
NONDESTRUCTIVE TEST METHODS FOR REINFORCED PLASTIC/COMPOSITE MATERIALS
George Epstein 3 Feb. 1969 42 p refs
(Contract F04701-68-C-0200)
(AD-686466; TR-0200(4250-20)-4; SAMSO-TR-69-78) Avail: CFSTI CSCL 11/4

A review is presented of various methods for nondestructive testing (NDT) of reinforced plastic/composite materials and structures. Visual inspections, ultrasonic methods, sonic methods, radiography, electrical properties, microwave techniques, thermal techniques, and other NDT methods are examined with regard to their characteristics, instrumentation, utility, and limitations. Recent developments are also discussed. Author (TAB)

N69-31008# Dayton Univ. Research Inst., Ohio.
CHEMICAL FACTORS INFLUENCING THE CHOICE OF AN OXIDE FIBER FOR REINFORCEMENT OF ALLOY SYSTEMS AT HIGH TEMPERATURES Technical Report, 9-26 Jul. 1968
John H. Meiser Mar. 1969 26 p refs
(Contract F33615-67-C-1187)
(AD-686447; UDRI-TR-69-01; AFML-TR-69-49) Avail: CFSTI CSCL 11/4

An investigation of single oxides was carried out to determine the suitability of the oxide to be formed into a fiber to act as reinforcement. Ability to strengthen alloy systems to 2000F was used as partial requirement for retention of the oxide. Further selection was based upon chemical properties. Three oxides (Al2O3, Y2O3, and ZrO2 (stabilized) were selected as meeting all basic chemical requirements for a fiber reinforcement. Author (TAB)

N69-31127# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRELIMINARY RESULTS OF STUDY OF HIGH TEMPERATURE ADHESIVE ACTION AND FRICTION OF OXIDES AND HIGH MELTING METALS WITH OXIDES IN A VACUUM AND IN GAS MEDIA
A. P. Semenov et al 18 Dec. 1968 12 p refs Transl. into ENGLISH from Akhd. Nauk SSSR. Inst. Met. Strukt. i Svoystva Zharopchnykh Met. Materialov (Moscow), 1967 p 109-114
(AD-686230; FTD-HT-23-656-68) CSCL 11/2

Friction measurements were made on a specially constructed apparatus; the materials studied were molybdenum, iron, cobalt, aluminum oxide, magnesium oxide, and cerium oxide. The coefficient of adhesion is given as a function of the relative temperature (ratio of test temperature to the melting temperature of the oxide) for the following systems: MgO-MgO, CeO2-CeO2, Al2O3-Al2O3, Fe-Al2O3, Mo-Al2O3, and Co-MgO. Author (TAB)

N69-31180# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INELASTIC CONSTANTS OF ORIENTATED GLASS-FIBER REINFORCED PLASTIC AS A FUNCTION OF THE TEMPERATURE
D. V. Zambakhidze et al 16 Dec. 1968 14 p refs Transl. into ENGLISH from Mekhan. Polimerov, Akad. Nauk Latv. SSR (Riga), no. 2, 1967 p 279-285
(AD-686234; FTD-HT-23-668-68) Avail: CFSTI CSCL 11/4

Results and theoretical interpretations are given for linear creep of an anisotropic, glass fiber reinforced plastic. Graphs showing elongation against time demonstrate that discrete relaxation time regions, in which creep rates are different, are operative. Temperature effects on nonelastic behavior were also obtained and shown in diagrams. Author (TAB)

N69-31253# Air Force Systems Command, Wright-Patterson AFB Foreign Technology Div.
RELATIONSHIP BETWEEN STRUCTURAL AND STRENGTH CHARACTERISTICS OF FIBER GLASS LAMINATES
A. S. Pranch et al 16 Dec. 1968 15 p refs Transl. into ENGLISH from Mekhan. Polimerov, Akad. Nauk Latv. SSR (Riga), no. 2, 1967 p 302-308
(AD-686233; FTD-HT-23-662-68) Avail: CFSTI CSCL 11/4

Several samples of card-web glass fiber-binder (70% epoxy resin) laminates were obtained; fiber weave amplitude and thickness of binder layer per layer of reinforcing fabric were obtained by microscopy. Theoretical reasoning gave the relation to tensile strength at break, for a given laminate, and the number of cycles before breaking as a function load applied and removed in a cyclic manner. Author (TAB)

N69-31259# General Electric Co., Schenectady, N.Y. Research and Development Center.
PHASE SEPARATION IN GLASSES
Richard J. Charles and A. M. Turkalo Apr. 1969 56 p refs
(Contract N00014-68-C-0126)
(AD-686176; S-69-1051) Avail: CFSTI CSCL 11/2

The following are technical reports of a research program titled Phase Separation in Glasses. The reports included herein are as follows: The origin of immiscibility in silicate solutions; The metastable immiscibility surface in the system Na2O-B2O3-SiO2; Stress induced binary diffusion; A technique for obtaining thin glass sections for transmission electron microscopy; Device for electrical conductivity measurements of glasses during heating and cooling; The depression constants of glass thermometers. TAB

N69-31283# Oklahoma Univ. Research Inst., Norman.
RESIDUAL STRESS MEASUREMENTS ON THIN ELECTRODEPOSITED FILMS
R. V. Feaster and Robert Jay Block Feb. 1969 48 p refs
(Contract AT(40-1)-3401)
(ORO-3401-10) Avail: CFSTI

The residual stress in thin films of Cr, Rh, Re, Au, and Ru, electrodeposited on polycrystalline substrates, was investigated. The morphology of the deposits on single crystal and polycrystalline substrates was determined using X-ray and electron diffraction techniques. Results indicate that simple lattice mismatch between coating and substrate was not by itself an adequate criterio from which coating stress could be predicted. Calculations of residual stresses based on Van der Merwe's equation predicted only relative stress levels. It was found that X-ray line broadening by itself could not be used for accurate measurements of residual stress. However, shifts of the X-ray diffraction peaks were always associated with substantial levels of stress. Author (NSA)

N69-31304# Joint Publications Research Service, Washington, D.C.
CONDUCTING POLYMER MATERIALS
V. Ye. Gul 7 Jul. 1969 35 p refs Transl. into ENGLISH from "Elektroprovodyashchiye Polimernyye Materialy" Moscow, Znaniye Publishing House, ser. 5, 1969 32 p
(JPRS-48359) Avail: CFSTI

The scientific aspects of conducting polymers, the technology for refining them, and their application in various branches of the national economy are investigated. The advantages of conducting polymers over metal conductors, utilization, molecular structures, influence of carbon black on conductivity, and production flow charts are presented. P.G.S.

N69-31308# Naval Research Lab., Washington, D.C. Chemistry Div.
INTERACTION OF WATER VAPOR WITH PRISTINE E-GLASS FIBER
Victor R. Deitz Dec. 1968 25 p refs
(AD-686377; NRL-6812) Avail: CFSTI CSCL 11/5

The surface of the E-glass fiber is subject to subtle chemical changes, as are all glass surfaces. An unmodified surface, pristine E-glass fiber was prepared directly from a melt of E-glass marbles. The experimental conditions were selected to measure adsorption on partially covered surfaces where the influence of surface groups can best be seen. The sample of E-glass fiber was selected so that the surface area was very much larger than the walls of the Pyrex container. The volumetric adsorption procedure employed for krypton was adapted for use with water vapor. Knowing the length, weight, and density of the pristine E-glass fiber, an independent value was determined for the cross-sectional area of adsorbed krypton at -195C. The adsorption and desorption of water vapor was followed between 90 and 150C, and simple Elovich kinetics were observed for times up to 2000 min. Adsorption isotherms for water vapor were calculated after the fractional decrease in pressure became < 0.01. The heat of adsorption for an estimated surface coverage of 0.4 was 7900 cal/mole; the corresponding heat of vaporization of water was 8000 cal/mole. The behavior of pristine E-glass fiber was compared with the behavior after treatments with liquid water. The complexity of a glass surface is obviously compounded after aqueous treatments, and the influence of this on gas adsorption is pronounced. Author (TAB)

N69-31335*# IIT Research Inst., Chicago, Ill. Technology Center.
DEVELOPMENT OF SPACE-STABLE THERMAL-CONTROL COATINGS Triannual Report, 1 Aug.–31 Oct. 1967
G. A. Zerlaut, G. Noble, and F. O. Rogers 15 Jan. 1968 81 p refs
(Contract NAS8-5379)
(NASA-CR-102216; IITRI-U6002-59) Avail: CFSTI CSCL 11C

It is shown that treatment of ZnO-extracted zinc orthotitanate with sodium acid phosphate and recalcination are both effective in increasing the stability of this pigment system. However, recalcination appears to be the most important of the two surface treatments. EPR studies of zinc orthotitanate were performed. Resonance was observed in zinc orthotitanate as prepared and on material that was extracted and then calcined. No spectra were obtained on material that was extracted only; extracted and phosphated; and, extracted, phosphated and calcined. A discussion of the solid-state behavior of zinc orthotitanate, and pigmented systems in general, are given. A very stable paint has been developed employing silicate-treated zinc oxide as the pigment in silicone-resin coating. Author

N69-31341*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EFFECTS OF STERILIZATION ON THE ENERGY-DISSIPATING PROPERTIES OF BALSA WOOD
A. B. Sorkin 15 Jun. 1969 34 p refs
(Contract NAS7-100)
(NASA-CR-103306; JPL-TR-32-1295) Avail: CFSTI CSCL 11G

The interest in the possible planetary landing of sterilized instrumented payloads has necessitated considerable study of impact limiters. Balsa wood has been found to offer a combination of properties that make it a very attractive candidate for impact limiter construction. An investigation was made of the energy-dissipating properties of balsa wood in sterilized, dry, and moist conditions. Ethylene oxide plus thermal sterilization was found to enhance the specific energy of balsa to 23,097 ft-lb/lb as compared with an average of 20,400 ft-lb/lb for samples in the moist (6–8% H_2O) condition. A study was made of possible screening tests that might facilitate the selection of balsa wood with uniform properties. No test was found that correlated with specific energy. Density variation within the range studied (8–10 lb/ft^3) did not have a significant relation to crushing properties, refuting previous indications of a relationship. The feasibility of enhancing or reducing scatter in the energy-dissipating properties of balsa was investigated. Plastic impregnation followed by irradiation induced polymerization was studied but failed to improve balsa's already outstanding specific energy. Author

N69-31375# IIT Research Inst., Chicago, Ill.
FIBER OPTICS WITH EXTENDED ULTRAVIOLET TRANSMISSION Triannual Report No. 4, 1 Sep.–31 Dec. 1968
W. R. Bratschun, A. M. Ali, A. G. Pincus, and M. A. Schwartz Jan. 1969 46 p refs
(Contract DAABG7-67-C-0542)
(AD-686338; ECOM-0542-4) Avail: CFSTI CSCL 11/2

Thermal expansion and viscosity-temperature measurements were made on candidate cladding and core glasses. Scaling-up processes were initiated and a comprehensive program for increasing uv transmission of lanthanum zinc borate and lanthanum barium calcium borate glasses as developed earlier was started. Author (TAB)

N69-31384# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Flight Dynamics Lab.
THE ORIGIN OF DEPOSITS FORMED ON THE SURFACE OF THERMAL CONTROL MATERIALS BY THE ACTION OF EXTREME ULTRAVIOLET RADIATION Technical Report, Jul. 1965–Apr. 1968
Vernon L. Mangold Feb. 1969 30 p refs
(AD-686428; AFFDL-TR-68-155) Avail: CFSTI CSCL 11/3

The phenomenon of surface deposits formed on selected white thermal control samples during extreme ultraviolet irradiation has been investigated. Information obtained in this experimental program indicates that the surface deposit was unique to the coating sample and not the result of the environmental chamber system contamination. Author (TAB)

N69-31397# Explosives Research and Development Establishment, Waltham Abbey (England).
FIBER FILLED RUBBERS
B. F. Brokenbrow, D. Sims, and A. L. Stokoe Aug. 1968 35 p refs
(AD-686455; ERDE-11/M/68) Avail: CFSTI CSCL 11/10

Nine rubbers, natural rubber, nitrile rubber, neoprene (chloroprene), Hypalon (chlorosulphonated polyethylene) butyl rubber, Viton (hexafluoropropylene/vinylidene fluoride), Hydrin rubber (epichlorhydrin/ethylene oxide copolymer), SBR (styrene/butadiene rubber) and an acrylate rubber, have been compounded with treated and untreated graded asbestos fibres and compared with similar carbon black filled vulcanisates by measuring their tensile properties. Author (TAB)

N69-31457# Naval Ordnance Lab., White Oak, Md.
SINGLE SPECIMEN DETERMINATION OF YOUNG'S AND BULK MODULI OF POLYMERS Summary Report
Robert W. Warfield, Joseph E. Cuevas, and F. Robert Barnet Feb. 1969 27 p refs
(AD-686388; NOLTR-68-212) Avail: CFSTI CSCL 11/9

A new method is presented for the rapid and consecutive determination of Young's and bulk moduli of polymeric solids in compression loading. Usually these properties are determined by separate measurements. However, by using an undersized specimen in a standard bulk compressibility tester it is possible to determine both moduli on the same specimen in a single test procedure. Initial loading of the undersized specimen results in a decrease in

length and an increase in diameter. From these changes Young's modulus may be calculated. Once the bore of the tester is filled, the application of additional pressure results in a decrease in the volume of the polymer from which the bulk modulus may be calculated. Both determinations may be made within minutes. The moduli values are in general agreement with published values and the calculated values for Poisson's ratio fall into the expected range.
Author (TAB)

N69-31485# IIT Research Inst., Chicago, Ill.
FRACTURE MECHANISMS IN POLYCRYSTALLINE NONMETALLIC MATERIALS Final Report, 31 Mar. 1967–30 Mar. 1968
O. Johari and N. M. Parikh Watertown, Mass. Army Mater. and Mech. Res. Center Apr. 1968 65 p refs
(Contracts DAAG46-67-C-0122; DA-19-066-AMC-288(X))
(AD-686301; IITRI-B6180-4; AMMRC-CR-69-02(F)) Avail: CFSTI CSCL 11/2

Fracture phenomena and their relation to dislocations and dislocation motion were studied during the course of the investigation. High-purity single crystals were stressed up to 60,000 psi. Although cracks formed in the crystals, no etch pits or associated dislocation motion was observed. X-ray techniques and transmission electron microscopy of thin films prepared by ion bombardment are proposed for determining dislocation velocity stress relationships. Present results indicate that the impurities play a major role in dislocation behavior in alumina and their presence is essential for formation of etch pits. Polycrystalline Lucalox of 5 micron, 20 micron, and 30 micron grain size was fractured at room temperature, 400, 700, and 1000C. Extensive cleavage and intercrystalline fracture were observed using the Scanning Electron Microscope. The extent of cleavage decreased with increase in temperature and grain size. These results are explained in terms of temperature dependence of fracture stress for cleavage and grain boundary fracture, stress concentration at sharp-edged pores, and favorable orientations of some grains relative to the loading axis for cleavage.
Author (TAB)

N69-31520# Systems Research Labs., Inc., Dayton, Ohio.
THE ELECTRICAL AND OPTICAL PROPERTIES OF REFRACTORY OXIDES Final Report, Aug. 1966–Jul. 1968
Walter C. Tripp and Edward T. Rodine Wright-Patterson AFB, Ohio ARL Dec. 1968 149 p refs
(Contract AF 33(615)-2765)
(AD-686300; SRL-11580; ARL-68-0221) Avail: CFSTI CSCL 11/2

A thermogravimetric study of the defect structure of alpha-Nb2O5 is reported and shows the results of weight change data over a range of oxygen partial pressures and over the temperature range of 900C to 1250C. The results of conductivity, ac and dc, measurements on Sc2O3 are reported and show that with commercially available material the electrical behavior is controlled by the impurity content. The thermoluminescence and related optical properties of some refractory oxides are discussed, and experimental results are presented. Work has been done primarily on Y2O3 and ThO2, with some effort devoted to ZnO, SnO2, MgO, CeO2 and Nb2O5. Experimental measurements reported include glow curves, excitation spectra, emission spectra, dosage studies, bleaching studies, initial rise and cleaned peak methods, fluorescence and absorption.
Author (TAB)

N69-31525# Factory Mutual Research Corp., Norwood, Mass.
GLOVEBOX WINDOW MATERIALS. A GLOVEBOX FIRE SAFETY APPLICATION
1969 35 p refs Sponsored by AEC
(TID-24896) Avail: CFSTI

An investigation of fire protection and operating requirements for glovebox window materials is described. A literature search was conducted. Selection criteria were established and tests conducted on various glass and plastic materials. Of the 17 different window materials tested, none was found to be ideal. The glasses lacked impact resistance, were etched by fluorides, and were brittle, while the plastics were flammable in various degrees and were easily scratched. A ranking was established for the more promising window materials: wired glass, laminated glass, and polycarbonates.
Author (NSA)

N69-31531# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Metallurgy.
PLASTIC DEFORMATION IN POLYCRYSTALLINE ALUMINA
A. H. Heuer Feb. 1969 20 p refs Presented at Brit. Ceram. Soc. Meeting on the Mechan. Properties of Ceram., London, 18–19 Dec. 1968 Submitted for publication
(Contract N00014-67-A-0404)
(AD-686111; TR-1) Avail: CFSTI CSCL 11/2

The various modes of plastic deformation possible in polycrystalline alumina - basal and non-basal slip, basal and rhombohedral deformation twinning, diffusional creep, and grain boundary sliding - are discussed. Recent experiments concerned with hot working of polycrystalline alumina (at temperature of approximately 1750 - 1950C) and the brittle-ductile transition in fine-grained alumina (at approximately 1200C) are interpreted with emphasis on the deformation mechanisms.
Author (TAB)

N69-31631# Coating and Chemical Lab., Aberdeen Proving Ground, Md.
DETERMINATION OF POLYHYDRIC ALCOHOLS IN ALKYD RESIN BY GAS LIQUID CHROMATOGRAPHY Final Report
George G. Esposito Mar. 1969 19 p refs
(AD-685821; CCL-260) Avail: CFSTI CSCL 11/3

Although alkyd resins have been the object of considerable research during the past 20 years, a general method for the analysis of polyols has not appeared in the literature. The type and amount of polyol used in the production of alkyd resins greatly influences the physical and chemical properties of alkyd-based coatings; therefore, it is important that quality control, relative to polyol content, be exercised. This report describes a procedure which can be used for the identification of a broad spectrum of polyhydric alcohols. In addition, polyols can be determined quantitatively. Sample manipulation is minimal and a simultaneous determination is made with resins containing more than one polyol. A resin sample is dried and then refluxed with butylamine. Polyols released during the aminolysis are reacted with a trimethylsilyl reagent forming their corresponding trimethylsilyl ethers. Separation of the polyol derivatives is performed on a 16 foot silicone grease column.
Author (TAB)

N69-31697# Coating and Chemical Lab., Aberdeen Proving Ground, Md.
ISOLATION OF SOLVENTS FROM ORGANIC COATINGS BY AIR-FLUSH VACUUM DISTILLATION TECHNIQUE
George G. Esposito Mar. 1969 14 p refs
(AD-685822; CCL-261) Avail: CFSTI CSCL 11/3

The analysis of solvents in organic coatings is hindered by the presence of binder, pigment, plasticizer, and additives. Prior to this investigation, a suitable method for complete isolation of solvents from other components in enamels and lacquers could not be found. This report describes a vacuum distillation procedure which is applicable to organic coatings having solvent systems composed of extremely low- and high-boiling materials.
Author (TAB)

N69-31699# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
A REVIEW OF MASS SPECTROMETRIC STUDIES RELATED TO GRAPHITE CORROSION IN THE MAGNOX AND AGR SYSTEMS
H. E. Evans and P. P. Jennings Jan. 1969 14 p
(RD/B/N-1178) Avail: AEC Depository Libraries

The results obtained in recent mass spectrometric studies of the species produced in a number of relevant gases by electron bombardment and gas discharges are briefly reviewed. The results are related to the graphite corrosion reactions in Magnox and AGR reactors. NSA

N69-31710# Massachusetts Univ., Amherst. School of Engineering.
STATIC FATIGUE OF ACID-ETCHED, SODA-LIME-SILICA GLASS RODS
John E. Ritter, Jr. and Dana L. Vrooman Apr. 1969 108 p refs
(Contract N00014-68-A-0146)
(AD-686120; THEMIS-UM-69-4) Avail: CFSTI CSCL 11/2

In studying the strength characteristics of pristine, soda-lime-silica glass using four-point bending, large deflections are imposed on the glass specimens. These large deflections lead to nonlinear relations between load and deflection and the assumptions of simple beam theory are no longer applicable. Without making the simplifying assumptions of simple beam theory, the nonlinear differential equation governing beam deflections in four-point bending was solved using numerical techniques. Author (TAB)

N69-31714# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
EVALUATION OF COATINGS FOR LITHIUM
Sam H. Pitts, Jr. 27 Feb. 1969 8 p refs
(Contract AT(29-1)-1106)
(RFP-1260) Avail: CFSTI

Coatings and coating techniques to protect lithium parts from atmospheric corrosion were investigated. These included organic coatings applied by various methods and conversion-replacement type coatings formed in solutions. An unsuccessful attempt was made to put a protective coating on lithium by conversion-replacement type surface reactions. Failure was due primarily to the lithium-water reaction, which took place during the reaction. Plastic coatings were more successful, but an absolute water vapor barrier was not obtained. The best coatings evaluated were the vapor deposited poly-p-xylylenes. Results indicated that it is not feasible to protect lithium from atmospheric moisture for long periods with organic coatings or by the formation conversion or replacement type surfaces. Organic coatings do have potential in protecting lithium for limited periods of times. This is especially true for atmospheres, such as room air, that have less than a 100% relative humidity. Author (NSA)

N69-31787# Princeton Univ., N.J. Frick Chemical Lab.
DIELECTRIC PROPERTIES OF POLYPROPYLENE OXIDE AS A FUNCTION OF CONCENTRATION
Ping-Chang Lue, Charles P. Smyth, and Arthur V. Tobolsky Apr. 1969 10 p refs
(Contract N00014-67-A-0151)
(AD-686080; ONR-TR-RLT-116) Avail: CFSTI CSCL 11/9

The frequency of maximum loss V(m) was measured in methyl cyclohexane solutions of polypropylene oxide. It was found that V(m) varies with weight % of polymer between 65% and 100%. Below 65% weight concentration of polymer V(m) was independent of concentration. It appears that in this lower concentration range V(m) is related to intramolecular motions of the polymer. Author (TAB)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N69-30410# Stanford Univ., Calif. Dept. of Operations Research.
DISCRETE DYNAMIC PROGRAMMING WITH A SMALL INTEREST RATE
Bruce L. Miller and Arthur F. Veinott, Jr. 31 May 1968 16 p refs
(Contracts Nonr-225(77); F44620-67-C-0045; Grant NSF GK-1420)
(AD-673225; TR-15) Avail: CFSTI CSCL 12/2

In a fundamental paper on stationary finite state and action Markovian decision processes, Blackwell defines an optimal policy to be one that maximizes the expected total discounted rewards for all sufficiently small interest rates $\rho > 0$. He also establishes the existence of a stationary optimal policy by a limit process that does not give a finite algorithm. The purpose of this paper is to prove this result constructively by devising a finite policy improvement method for finding stationary optimal policies. The algorithm is based on a new representation of the vector of expected discounted returns under a stationary policy as a power series in the interest rate for all small enough $\rho > 0$. Author (TAB)

N69-30428# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering
NEARLY BEST LINEAR UNBIASED ESTIMATORS OF THE LOCATION AND SCALE PARAMETERS OF THE CAUCHY DISTRIBUTION BY THE USE OF CENSORED ORDER STATISTICS
Robert B. Chamberlain (M.S. Thesis) Dec. 1968 182 p refs
(AD-685112; GRE/MATH/68-02) Avail: CFSTI CSCL 12/1

The Nearly Best Linear Unbiased Estimators (NBLE or NBLUE) of location (mu) and scale parameter (sigma) is developed and applied to the Cauchy distribution for N = 15(1)40. For the Cauchy the first and last two order statistics are always censored. Estimator coefficients and relative efficiencies with respect to the minimally censored samples are developed for (1) additional censoring symmetrically from above and below and (2) additional censoring from above only. The idiosyncrasies of the Cauchy are explored along with the efficiencies and applicability of other alternative procedures. Author (TAB)

N69-30450 Pennsylvania Univ., Philadelphia.
A HOMOTOPY GROUP OF ALGEBRAIC ARCS FOUND BY SMOOTHED APPROXIMATIONS
Paul Francis Cherenack (Ph.D. Thesis) 1968 248 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.20 Order No. 69-77

The main consideration in studying algebraic homotopy groups is to determine whether the naive notion of algebraic homotopy group of a real algebraic variety makes sense. The objects to be studied, in imitation of the ordinary fundamental group, are the analytic images of [0,1] and [0,1] × [0,1], the images contained in appropriate real algebraic varieties of dimension 1 or 2. These objects are called, respectively, algebraic arcs and algebraic squares. The chief difficulty in defining an algebraic homotopy group is the transitivity of the homotopy relation. Dissert. Abstr.

N69-30452 George Washington Univ., Washington, D.C.
STATISTICAL DECISION SYSTEMS: THEORETICAL AND APPLIED RESULTS
Lee Bjork Sanderson (Ph.D. Thesis) 1968 116 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-704

This dissertation considers the multivariate statistical problem of deciding which one of several states of nature is true. Several criteria of optimality are examined and from each of the criteria various discrimination procedures are developed. In most cases the discrimination between two states of nature has been investigated. For some criteria the probability distributions of the two states of nature must be known while for others only the mean vectors and covariance matrices of the vector variables are known. The primary effort is directed toward the development of discrimination techniques applicable to problems involving vectors of large dimensionality with the major emphasis on the problem of variable selection. These criteria are Kullback's information numbers, the Mahalanobis distance, the Bhattycharya distance, Chernoff's information number and the linear clustering criterion value. Dissert. Abstr.

N69-30453 Illinois Univ., Urbana.
ON ISOTROPY TYPES OF COMPLEXES WITH APPLICATION TO KNOTS
Joseph Warren Corbett (Ph.D. Thesis) 1968 37 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-1319

A polygonal knot K is said to be inscribed in a very skew curve C, in E_3, if there is an inscription K' of K in C such that K' is equivalent to K as a knot. A tame knot is said to be inscribed in C if it is equivalent to a polygonal knot inscribed in C. It is shown that an arbitrary tame knot K can be inscribed in the very skew curve $Q = \{(x,y,z) \mid x = t, y = t^2, z = t^3\}$, in E_3 and therefore in any very skew curve which can be deformed isotopically onto Q within the class of very skew curves. This means, by Cairn's result, that the parametric order of the vertices of such an inscription will specify a knot equivalent to K; that is K can be specified by a permutation. The method can be extended immediately to any finite system of disjoint simple closed curves which it is then possible to specify by a product of permutations. Dissert. Abstr.

N69-30455 Oregon Univ., Eugene.
A CATEGORICAL SETTING FOR THE LOCAL THEORY OF PRIMES
Joel Elmer Schneider (Ph.D. Thesis) 1968 53 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-42

Attention has been focused on the study of those properties enjoyed by a commutative ring with identity which involve a fixed prime. A fundamental problem is to gain control over the primes. The technique introduced here is the development of a categorical setting within which to work. The class of pairs (F,P) where F is a field and P is a prime of F is made into a category $\mathcal{F}$. Invariants are introduced: a "residue" object in $\mathcal{F}$ and an ordered group. The residue object satisfies a universal mapping property with respect to a known full subcategory of $\mathcal{F}$ and generalizes the classical residue class fields. The group is the value group of a valuation of the field. Injective objects and monomorphisms are studied with the former being listed explicitly. This result is used to give a relationship between monomorphisms into injective objects and ramification for finite primes of normal number fields. Dissert. Abstr.

N69-30457 Stanford Univ., Calif.
SUBRECURSIVENESS AND FINITE COMPUTERS
David Bruce Thompson (Ph.D. Thesis) 1968 66 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-305

R. W. Ritchie has shown that the class of recursive functions computable (in one of the usual positional notations) by a Turing machine, using an amount of tape bounded by a linear function of the length of the argument, is identical with the class E^2 of the Grzegorczyk hierarchy. Using appropriate measures of storage space, the same statement holds for much broader classes of computing machines; in fact, a quite straightforward analysis of the matter suggests that it holds for any reasonable machine model. Consider the more restricted class of functions computable with a linear bound on storage and a polynomial bound on computation time. It is shown to be identical with the class F^2 of functions obtainable from the identity and dyadic concatenation functions by repeated operations of explicit definition and bounded recursion on notation. Dissert. Abstr.

N69-30459 Washington Univ., Seattle.
BOUNDED ITERATES IN BANACH ALGEBRAS
Bertram Manual Schreiber (Ph.D. Thesis) 1968 102 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-1213

The question of bounded powers from the point of view of general Banach algebra theory is discussed. The specific case of convolution powers of measures on locally compact groups is given. The Boolean ring of subsets of an Abelian group generated by all cosets of subgroups is studied. The Gelfand spectral radius formula is given and the conditions similar to the formula, and the consequences of it, appear in a number of contexts in analysis; for example, uniformly bounded groups of linear operators, ergodic theory, and the stability of linear, finite-difference approximations to the solution of an initial-value problem in differential equations. Dissert. Abstr.

N69-30461 Oregon Univ., Eugene.
THE STRUCTURE OF PARTIALLY ORDERED SPACES AND A PROBLEM IN SEMIGROUPS
Edward Dmytro Tymchatyn (Ph.D. Thesis) 1968 74 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 69-49

The main part of this thesis deals with the structure of partially ordered spaces. The final chapter provides a solution to a problem of compact semigroups. Gathered are some of the basic results in the theory of partially ordered spaces. The most important new result is a partial solution to the following problem: Let X be a compact partially ordered space and let C(X) denote the space of compact subsets of X with the finite topology. Under what conditions is the function f: X → C(X) defined by $f(x) = \{y \in X \mid y \leq x\}$ continuous? Let X be a compact space with a closed partial order and let L (resp. M) denote the set of minimal (resp. maximal) elements of X. Necessary and sufficient conditions are given for X to be covered by a compact family of maximal totally ordered subsets. Also constructed is an example which answers affirmatively the following problem: Let S be a compact topological semigroup with a zero, and a totally ordered class space. If S contains a one-parameter subsemigroup which contains the zero and the identity of S, can S have more than two regular classes? Dissert. Abstr.

N69-30463 Oregon Univ., Eugene.
TOPOLOGICAL SEMIVALUATIONS ON A COMMUTATIVE BANACH ALGEBRA
Michael Banga Tomlinson (Ph.D. Thesis) 1968 48 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-48

By an Abelian semigroup with compatible partial order, we mean an ordered pair $(\Gamma, \leq)$ where Γ is an Abelian semi-group (written multiplicatively) having an identity 1, and $\leq$ is a partial order on Γ satisfying $\alpha \leq \beta$ then $\alpha\cdot\gamma \leq \gamma\cdot\alpha$, for all α, β, γ in Γ. We also assume Γ has a zero satisfying 0, $0\cdot\alpha = \alpha\cdot 0 = 0$, for

all α in Γ, and ii). $0 \leq \alpha$, for all α in Γ. With any nonempty subset S of a commutative ring R with identity, there is associated in a natural way just such a pair $(\Gamma, \leq)$, which we denote by $\Gamma(S)$. For certain "extreme" cases of S, $\Gamma(S)$ has a rather simple algebraic and lattice structure. This paper is concerned with the structure of $\Gamma(S)$ when R is taken to be C(X), the Banach algebra of complex valued continuous functions (with the usual pointwise operations and supremum norm) on a compact Hausdorff space X, and S is a topologically closed "extreme" case. Dissert. Abstr.

N69-30464 Nebraska Univ., Lincoln.
ON THE CONSTRUCTION AND ANALYSIS OF MULTIFACTORIAL EXPERIMENTAL DESIGNS
Donald Alfred Anderson (Ph.D. Thesis) 1968 194 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 69-18006

Problems in the construction and analysis of multifactorial designs are considered for three classes of experimental situations as follows: (1) fractional factorial designs (fractions) of resolution IV for the 2^m, 3^n, and $2^m \times 3^n$ series, (2) multidimensional designs for the additive model, and (3) multidimensional designs for models containing one or more interaction terms. The primary objective in each case is the construction of economic designs for which the analysis may be carried out with relative ease and the results readily interpreted. General properties of multidimensional partially balanced designs and the corresponding association schemes are considered for the additive model. Combinatorial identities on the parameters of these designs are obtained which are useful in their construction. The complete connectedness of a multidimensional designs in general is studied. Dissert. Abstr.

N69-30469 Stanford Univ., Calif.
OPERAND INVESTIGATION OF STOCHASTIC SYSTEMS
Michel Yves-Louis Depeyrot (Ph.D. Thesis) 1968 250 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.25 Order No. 69-212

This dissertation presents new results in the structural analysis of finite-state stochastic systems. A new model of transition-output (T) automaton is introduced, which subsumes the Moore and Mealy machines of switching theory and provides a complete conversion procedure between identification-oriented stochastic automata and decision-theoretic or event-control oriented models. For any appointed initial distribution state, the behavior of a T-automaton Σ_f defines a stochastic system, called computable, whose algebraic features are formalized in terms of convex operands (representation semigroups with submarkov matrices). Interchangeability (simulation) of two machines and indistinguishability (equivalence) of their input-output behaviors are reduced to operand-divisibility. From the necessary internal features that can be identified by gedanken experiments, the characterization of a system realization class is derived in terms of its normal forms. Dissert. Abstr.

N69-30562 South Carolina Univ., Columbia.
LOCALLY CONVEX PSEUDO-TOPOLOGICAL VECTOR SPACES
John Stanley Hinkel (Ph.D. Thesis) 1968 100 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-471

Pseudo-topologies and pseudo-topological vector spaces are briefly considered to clarify the development and obtain some new results. The idea of base and subbase is introduced and quotient structures are studied. Locally convex pseudo-topological vector spaces are shown to have a base of filters converging to zero which satisfy every property of the filter of neighborhoods of a locally convex topological vector space with the exception that each of its elements is not necessarily absorbant. Some of the elementary properties of locally convex pseudo-topological spaces are developed and a condition for the continuity of linear maps is obtained. A locally convex pseudo-topological structure is defined for L(E,F) where E and F are locally convex pseudo-topological vector spaces. The continuity of some important canonical maps is obtained and some linear homeomorphisms established. The derivative of mappings between locally convex pseudo-topological vector spaces is studied. The elementary properties are proved and a p-chain rule obtained. Dissert. Abstr.

N69-30563 Pennsylvania Univ., Philadelphia.
A REPRESENTATION-SYSTEM FOR PARSING PROCEDURES
Daniel Alfred Walters (Ph.D. Thesis) 1968 324 p
Avail: Univ. Microfilms: HC $14.65/Microfilm $4.15 Order No. 69-181

A system is described for representing a class of parsing procedures for context-free phrase-structure grammars. This system, called RS, can serve as a unifying basis for the specification, description and investigation of such procedures. RS is based on the reduction systems of problem solving used in such areas as machine theorem proving. It has the form of a procedure schema, a general parametrized parsing procedure. Any appropriate specification of the parameters yields a parsing procedure. These parameters specify transformations to be applied to derivation problems. The application of these transformations is directed by the fixed control mechanism of RS; their effect is to reduce a problem to a set of problems that are easier to solve. Dissert Abstr.

N69-30585 Delaware Univ., Newark.
ON THE QUANTITATIVE ASPECTS OF NONLINEAR DIFFERENTIAL EQUATIONS
Stanley Edmund Jones (Ph.D. Thesis) 1967 82 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 69-1129

A concept of nonlinear superposition is introduced and some techniques for solving nonlinear ordinary and partial differential equations are discussed. The nonlinear superposition idea is considered. Examples are included to illustrate the concepts. One of these examples demonstrates the fact that any homogeneous, first order, linear differential equation has an uncountable number of nonlinear superposition principles. Two methods for finding solutions to differential equations are introduced. The first of these is an application of the similarity variable technique to ordinary differenital equations. The second consists of a generalization of the method of Earnshaw. Solutions to some equations are obtained and these solutions are utilized. Dissert. Abstr.

N69-30586 Stanford Univ., Calif.
THE SIGN-REGULARITY PROPERTIES OF A CLASS OF GREEN'S FUNCTIONS FOR ORDINARY DIFFERENTIAL EQUATIONS AND SOME RELATED RESULTS
John Marshall Karon (Ph.D. Thesis) 1968 100 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-240

Results are developed on generalized splines in two directions. The sign-regularity properties of a class of Green's functions for ordinary differential equations are studied. Applications are made to interpolation by generalized splines satisfying prescribed boundary conditions. A generalized spline approximation method is developed generalizing the Bernstein polynomials. Dissert. Abstr.

N69-30587 Oklahoma Univ., Norman.
VECTOR BUNDLES AND PROJECTION TENSORS

Tony Maurice Johnson (Ph.D. Thesis) 1968 40 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-17589

Let M be a C^∞ Riemann n-manifold with positive definite metric tensor g. Let T(M) be the tangent bundle of M. Given with a semi-Riemannian metric g, T(M) is made into an extended Riemann manifold of M. Relationships between geometric objects on the two manifolds are studied locally. Among the results obtained are: (1) The extended Riemann manifold of M has constant curvature if and only if it is flat, and then M is also flat. (2) If M has a constant curvature, then its extended Riemann manifold is a symmetric manifold. (3) There exists no M whose extended Riemann manifold is a recurrent manifold. (4) The number of linearly independent, parallel vector fields on the extended Riemann manifold of M is exactly twice the number of those on M. A Myller configuration is generalized and concepts of relative parallelism and relative conjugacy for vector fields of the configuration are defined.
Dissert. Abstr.

N69-30591 Arizona State Univ., Tempe.
A UNIQUENESS PRINCIPLE AND THE HILBERT INVARIANT INTEGRAL IN GENERAL FIELD THEORY
Michael Kelly Garrity (Ph.D. Thesis) 1969 96 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-1290

The principle of uniqueness is developed and mass is introduced as an integrating factor which restores uniqueness in a nontrivial dynamical case. An equivalence is shown to Newtonian dynamics of conservative fields. A natural extension to electrodynamics is made by allowing the field to become an inhomogeneity in the equations for mass energy. A more general metric, the Fermi Walker metric, is considered and a corresponding mass energy density is determined from the uniqueness condition. The principle of uniqueness is extended to the general field by means of the Weierstrass E function and the Hilbert invariant integral. The mass energy density becomes the field parameter of the extremals upon which the Hilbert invariant integral is based. The main advantage of this formulation is its generality and its correlation with experimental data in the form of trajectories in spacetime. The main disadvantage is the lack of a systematic approach to the choice of extremal and field parameter form.
Dissert. Abstr.

N69-30599 Polytechnic Inst. of Brooklyn, N.Y.
OPTIMAL TIME ALLOCATION IN COMPLEX TASKS
Ronald Robert Yager (Ph.D. Thesis) 1968 236 p
Avail: Univ. Microfilms: HC $10.80/Microfilm $3.05 Order No. 68-16294

The problem-solving situation is studied from an input–output point of view, with emphasis on the following two aspects. First, the expected payoff is related to the time spent analyzing the various components of the problem. Second, the optimal allocation of a finite amount of time among m independent problems is derived in terms of the complexities of the problems, and the correlation between each problem and the problem solver's ability and experience. By alluding to the stochastic theory of learning it is shown that, in general, the expected payoff in a problem-solving situation is a concave function of time satisfying four conditions. Justifications are given for the approximation of the payoff by an exponential function of time. The theory of hypothesis testing in the presence of white Gaussian noise is also used to verify these assumptions about the functional form of the expected payoff.
Dissert. Abstr.

N69-30610*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE X^2 STATISTIC AND THE GOODNESS OF FIT TEST
Peter D. Argentiero, Robert A. Morris, (Md. Univ., College Park) and Robert H. Tolson (NASA, Langley Res. Center, Langley, Va.) Washington Jun. 1969 134 p refs
(NASA-TR-R-313) Avail: CFSTI CSCL 12A

The probability density function of the X^2 statistic is derived. The applicability of the X^2 statistic to goodness of fit tests and its approximation by the chi-square variable are discussed in some detail. Tables of critical values of the X^2 statistic are provided for a range of sample sizes N and equiprobable categories K which prove useful in goodness of fit tests. An example is given to demonstrate that the proper application of tables of critical values of X^2 can add considerable precision to a goodness of fit test when small samples are involved.
Author

N69-30613 California Inst. of Tech., Pasadena.
INVARIANT SUBSPACES IN HILBERT AND NORMED SPACES
Richard Forsythe Taylor (Ph.D. Thesis) 1968 38 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-537

This dissertation concerns itself with the following question: Suppose T is a bounded linear operator from an infinite dimensional Hilbert space into itself. What are sufficient conditions to imply the existence of a nonzero, proper subspace M of H such that $T(M) \subseteq M$? The methodology used to approach the question is in line with the methods developed by Aronzajn and Smith and Bernstein and Robinson. The entire thesis is exposited within the framework of nonstandard analysis as developed by Robinson. The dissertation develops the necessary theory involved, and presents a necessary and sufficient condition for T to have a proper invariant subspace. The conditions involve assumptions on certain finite dimensional approximations of T.
Dissert. Abstr.

N69-30629 Illinois Univ., Urbana.
STRESSES IN COMPOSITE AXISYMMETRIC SHELLS BY THE FINITE-DIFFERENCE METHOD
Patrick Larry Corbin (Ph.D. Thesis) 1968 101 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-1320

A finite-difference method has been developed for the determination of stress concentration factors in plane and axially symmetric elasticity problems which cannot be solved by classical methods. A sample problem indicates that the method is adaptable, and provides reasonable accuracy with a relatively small number of mesh points. Fourth order difference quotients were used, and were found to be approximately 20 times as effective as second order differences. A further gain in efficiency was realized by writing the fourth order differences in skewed form so that no mesh points were outside the body. The problem appears to be insensitive to round off errors. The system of algebraic equations obtained was solved directly in single precision with no apparent round off difficulties. The sample problem chosen included a fillet in a reentrant corner.
Dissert. Abstr.

N69-30641 Nebraska Univ., Lincoln.
INVESTIGATIONS ON THE CONSTRUCTION AND EXISTENCE OF BALANCED FRACTIONAL FACTORIAL DESIGNS OF 2^M SERIES
Dharam Vir Chopra (Ph.D. Thesis) 1968 122 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-18012

A partially balanced array with two symbols, which in fact is a balanced fractional factorial design of 2^m series, is defined as follows: A partially balanced array (PBA) T with parameters (m, N, 2, t) and index set $(\mu_0, \mu_1, \mu_2, \ldots \mu_t)$ is an $(m \times N)$ matrix with elements 0 and 1 (say) such that in every $(t \times N)$ submatrix, every vector of weight i occurs μ_i times as a column. The array T is equivalent to a design obtained by taking the N columns of T

as assemblies. Using the matrix occurring in the normal equations obtained when T is considered as a design, a new set of necessary conditions for the existence of these arrays has been obtained for the case t = 4. Using the expressions derived herein, the trace, determinant, or the largest root of the covariance matrix can be obtained. A set of diophantine equations, which are also necessary for the existence of PB arrays, has been derived. Dissert. Abstr.

N69-30643 Oregon Univ., Eugene.
PLACES ON COMMUTATIVE RINGS
Robert Allen Kreiss (Ph.D. Thesis) 1968 71 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 69-32

A place between commutative rings is defined to be a partial ring homomorphism with the inverse image of finite primes and their idealizers being finite primes. This concept generalizes the classical concept of a place between fields and explicitly characterized all places between rings which are not ring homomorphisms. To characterize those ring homomorphisms which are places it is sufficient to study one-one ring homomorphisms. The inclusion mapping of R into S for R a subring of a commutative ring S is a place, if and only if, the inclusion mapping of $\theta_I(R)$ into $\theta_I(S)$ is a place for each minimal prime ideal I of S where θ_I: S→S/I. In effect, this reduces the problem to characterizing when the inclusion mapping of a domain into a domain is a place. An important instance of this is the fact that the inclusion mapping of a domain in every larger domain is a place if and only if the inclusion mapping of the domain in its quotient field is a place. Dissert. Abstr.

N69-30691 Illinois Univ., Urbana.
ON THE BEHAVIOR OF THE INTEGRAL CURVES OF A THIRD ORDER AUTONOMOUS SYSTEM OF DIFFERENTIAL EQUATIONS IN A NEIGHBORHOOD OF A CRITICAL POINT
Charles Emery Roberts, Jr. (Ph.D. Thesis) 1968 178 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 69-1422

The nature of the stability of the critical point (p,O,O), and the behavior of the integral curves in a neighborhood of this critical point for the third order autonomous system of differential equations are investigated. As a by-product of this study some results are established for general third order autonomous systems of differential equations. It is shown that the vector field determined by a nonlinear system of differential equations becomes similar to the vector field determined by a corresponding linear system as one approaches a simple critical point. The concept of entering a critical point (that is, the concept of an integral curve having a limiting tangent as it approaches a critical point) is defined, and necessary and sufficient conditions for an integral curve to enter a simple critical point at the origin with direction cosines are established. Dissert. Abstr.

N69-30692 Boston Univ., Mass. Graduate School.
CHEBYSHEV APPROXIMATION OF DISCONTINUOUS FUNCTIONS
Bernard Harven Rosman (Ph.D. Thesis) 1968 74 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 68-18094

Let f(x) be a bounded function continuous on [0,1] except for a finite number of jump discontinuities. The results are extended in a straightforward way to general linear approximation. The extension to rational approximation is not as direct. This is due mainly to the fact that the required number of elements in a reference set varies with the specific rational function under consideration. For functions with only interior jump discontinuities we deal with these complications and extend the theory to rational approximation. Dissert. Abstr.

N69-30693 Pennsylvania Univ., Philadelphia.
AN APPROACH TO SOLVING LINEAR DISCRETE OPTIMIZATION PROBLEMS
Richard Harvey Roth (Ph.D. Thesis) 1968 125 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-163

The problem of finding an n-dimensional vector $X^T = (x_1, x_2, \ldots x_n)$ which minimizes CX subject to the constraints AX ≥ B is presented. The approach taken in solving this problem is a combination of partial and random search. The partial search moves from randomly chosen starting points to precisely characterized local optima. Random search is then reapplied in an attempt to overcome the problem of generating a local optimum which is not globally optimum. Partial search is conducted by moving through a (k,m)-neighborhood structure defined over the space of possible solutions. Various properties of k and m are shown to hold for different optimization problem structures. Initial points are selected by sampling of a uniform probability distribution. Dissert. Abstr.

N69-30694 Illinois Univ., Urbana.
ON RESPIRATIONS OF LIE ALGEBRAS OF CLASSICAL TYPE
Thomas John Kearns (Ph.D. Thesis) 1968 70 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-1369

The methods of Curtis, Ree, and Kostant are used to investigate the representations of classical Lie algebras by means of the representations of the corresponding algebras over the complex numbers. Given a regular basis for a representation of the algebra over the complex numbers, reduction modulo a prime p yields a restricted representation of the classical Lie algebra over an arbitrary field of characteristic p. The general theory is applied to the three-dimensional simple algebra. This algebra is shown to be of unbounded (restricted) type. It is proved that different regular bases for a representation at characteristic 0 can produce nonisomorphic representations at characteristic p. The indecomposable representations of composition series length two are completely classified and the results are used to prove a necessary and sufficient condition that a restricted representation of this algebra be completely reducible. Dissert. Abstr.

N69-30729*# Polytechnic Inst. of Brooklyn, Freeport, N.Y. Dept. of Electrical Engineering.
THRESHOLD ANALYSIS OF PHASE LOCKED LOOPS
Paul W. Osborne and Donald L. Schilling 1969 121 p refs
(GRANT NGR-33-006-020)
(NASA-CR-103243; PIBEE69-002) Avail: CFSTI CSCL 12A

A new method for estimating the expected number of cycle slips in phase locked loops is presented. It is assumed that the noise is a deterministic function, which is defined as most-likely noise. The real noise driving the phase locked loop is derived from an IF filter driven by white noise. The resulting low-pass equivalent noises are replaced by conditional expectations. The method is applied to the first, second, and third order loops, with and without modulation, for modulation indexes of 3 and 12, and also to the FM discriminator (which can be represented by a phase locked loop with infinite loop gain). The IF filter used was a cascade of two identical single-tuned stages, each stage having a normalized 3 dB bandwidth of ± 1 radian per second. The results are presented in normalized form. Experimental results are presented which compare favorably to the theoretical results obtained. Author

N69-30741 Illinois Univ., Urbana.
LOCAL CONNECTIVITY OF THE SPACE OF HOMEOMORPHISMS OF A NON-COMPACT MANIFOLD

Peter Robin Hall (Ph.D. Thesis) 1968 75 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 69-1351

Let M be a non-compact 2- or 3-manifold with boundary. Let T be any triangulation of M and let ρ be the natural metric. Let $H_\rho(M)$ denote the space of homeomorphisms of M onto itself with metric ρ. It is shown that $H_\rho(M)$ is locally contractible if M is a 2-manifold with boundary and that $H_\rho(M)$ is LC^n for all n if M is a 3-manifold with boundary. These results are then used to obtain results on locally trivial fiber spaces. Typical of these is the following. Let f be a totally regular mapping of a complete metric space X onto a finite dimensional metric space Y such that each inverse under f is uniformly isomorphic to (M,δ), where (M,δ) is a 3-manifold with boundary and δ is the natural metric for some triangulation of M. Then (X,Y,M,f) is a locally trivial fiber space. Dissert. Abstr.

N69-30744 North Carolina Univ., Chapel Hill.
SOME ITERATIVE METHODS FOR APPROXIMATION OF FIXED POINTS AND SOLUTION OF FUNCTIONAL EQUATIONS IN BANACH SPACES
William Grady Dotson, Jr. (Ph.D. Thesis) 1968 89 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-1607

The structure of Mann iterative processes is studied in locally convex Hausdorff linear topological spaces and in normed linear spaces; the concepts of regular substructure and normality are introduced in the classification of these processes. The class of normal Mann iterative processes is then applied to the approximation of fixed points of several types of nonlinear mappings in Banach spaces, and to the solution of functional equations involving these nonlinear operators. Our main results here concern the strong and weak convergence of the iterative processes (under various hypotheses on the operators and the processes) in strictly convex and uniformly convex Banach spaces. Some fixed point theorems are a natural outgrowth of this work, and are developed. Finally, the mean ergodic theorem of Eberlein and a generalized Cesaro iterative process are applied to the solution of certain linear functional equations in Banach spaces. Dissert. Abstr.

N69-30753*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LOW-ORDER CLASSICAL RUNGE-KUTTA FORMULAS WITH STEPSIZE CONTROL AND THEIR APPLICATION TO SOME HEAT TRANSFER PROBLEMS
Erwin Fehlberg Washington Jul. 1969 46 p refs
(NASA-TR-R-315) Avail: CFSTI CSCL 12A

In an earlier report, the author derived fifth-to eighth-order Runge–Kutta formulas with stepsize control. In this paper, similar first- to fourth-order formulas are developed. Such low-order formulas are of interest in some heat transfer problems. It is well-known that the parabolic partial differential equations of such problems can be reduced to ordinary differential equations. However, it is also well-known that the application of Runge–Kutta methods to such problems is often very time-consuming. Higher-order formulas do not offer advantages in this respect, since stability considerations, resulting from the exponential character of the solution, exclude an increase of the integration stepsize that would make such high-order formulas meaningful. Therefore, low-order Runge–Kutta formulas can be expected to solve such problems more efficiently than any high-order formula. For the efficiency of Runge–Kutta formulas, it is essential that their truncation errors be as small as possible. Author

N69-30758# Argonne National Lab., Ill. Applied Mathematics Div.
COMPARISON OF SEVERAL ADAPTIVE NEWTON–COTES QUADRATURE ROUTINES IN EVALUATING DEFINITE INTEGRALS WITH PEAKED INTEGRANDS
K. E. Hillstrom Nov. 1968 26 p refs
(Contract W-31-109-ENG-38)
(ANL-7511) Avail: CFSTI

The performance of five different adaptive quadrature schemes, based on Newton–Cotes (2N + 1)-point rules (N = 1, 2, 3, 4, 5) are compared for approximating the sets of definite integrals $\int^1_{-1} (x^2 + p^2)^{-1}\,dx$, $\int^1_0 x/(1.1 - x)^p\,dx$, and $\int^3_0 x^p(x - 2)(x - 3)\,dx$ with relative accuracy ϵ. FORTRAN 4 listings of the comparison routine, the integrand and integral evaluation sub-routines, and the five adaptive quadrature subroutines are appended. Author (NSA)

N69-30785 Northwestern Univ., Evanston, Ill.
ON G-ALGEBRA EXTENSIONS
Kathleen Charlotte Salter (Ph.D. Thesis) 1968 66 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-1931

Investigations of G-algebra extensions are carried out employing various algebraic functions and properties such as mappings, projections, isomorphisms, commutative rings, cohomology groups, and equivalence classes of extensions. Groups of some special examples are computed. Dissert. Abstr.

N69-30770 Pennsylvania Univ., Philadelphia.
ABELIAN APPROXIMATE AUTOMORPHISMS
Frank Hood Young (Ph.D. Thesis) 1968 27 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-188

An approximate automorphism of an algebra A is an automorphism of $A[[t]]/(t^m)$ of the form $1 + t\phi + \ldots + t^{m-1}\phi_{m-1}$, where $\phi_i: A \to A$. An Abelian approximate automorphism has the property that the coefficient functions commute under composition. It is shown that a derivation ϕ can be decomposed into the sum of a semisimple derivation ϕ_S and a nilpotent derivation ϕ_N, possibly defined only over some extension field of the original ground field. If $A(\phi)$ denotes the Abelian obstruction exponent of ϕ, and if ϕ_S and ϕ_N are defined over some tame extension of the original ground field, then the Abelian obstruction exponent is defined. Dissert. Abstr.

N69-30771 Rutgers Univ., New Brunswick, N.J.
AN EVALUATION OF AN ASYMPTOTIC FORMULA FOR FACTOR LOADING VARIANCE BY RANDOM SAMPLING METHODS
Norman Wexler (Ph.D. Thesis) 1968 68 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-1062

Three questions were investigated: (1) Are asymptotic formulas applicable to samples as small as 100 cases? (2) What are the effects of replacing population parameters by estimates in asymptotic formulas? (3) What is the nature of differences between empirical and asymptotic loading variances when an analytical rotation applied to a factor matrix employs the population transformation matrix and when it employs a sample transformation matrix. The problem was investigated by means of two artificial experiments. Each experiment assumed a different hypothetical population; however, the procedures were identical. The first population factor matrix was in substantial conformity with simple structure criteria. To represent a more realistic situation, a second population was derived from the first but with a procedure to induce a departure from good simple structure. Dissert. Abstr.

N69-30818*# Maryland Univ., College Park. Computer Science Center.
A STOCHASTIC MODEL OF AN INFORMATION CENTER

Jack Minker Apr. 1969 28 p refs
(Grants NGR-21-002-197; NGL-21-002-008)
(NASA-CR-103214; TR-69-90) Avail: CFSTI CSCL 12A

In a recent paper the author investigated a stochastic model relevant to information handling centers best typified by computer utilities and document storage and retrieval centers. The growth characteristics of information centers were evaluated for retirement policies that govern when items are retired from a primary store to a less accessible store. The results obtained assumed that the primary store was of unbounded capacity. In this paper this restriction is removed, and the case where the primary store has a finite capacity is considered. A set of integral equations is derived for the expected number of items in the primary store. The integral equations depend only upon the arrival distribution for documents, the request distribution, and the parameters associated with the retirement policy. No particular limiting assumptions have been made with respect to the form of the distributions. The set of integral equations are solved for document arrivals that follow a Poisson distribution. The expected value of the size of the store approaches the result given previously as M, the size of the primary store, becomes unbounded. Author

N69-30824 South Carolina Univ., Columbia.
A SIMULATION STUDY OF THE IMPACT OF MULTICOLLINEARITY ON LEAST-SQUARES ESTIMATES
Merwyn Lee Elliott (Ph.D. Thesis) 1968 107 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-468

Utilized is the simulation and the Monte Carlo method to investigate the effect of multicollinearity on the estimation of regression coefficients. The question studied was whether multicollinearity necessarily poses serious problems in estimation. A three-variable model was examined with differing combinations of parameter values. The simulation study indicated that the estimates of regression coefficients may not be severely affected by multicollinearity under certain combinations of parameter values—especially when the multiple correlation is high relative to the simple zero-order correlation between the explanatory variables. The simulation process was suggested as a tool for the user of regression analysis for determining the severity of the effects of multicollinearity in a specific regression application. Dissert. Abstr.

N69-30828 Stanford Univ., Calif.
CONVERGENCE IN DISTRIBUTION OF STOCHASTIC INTEGRALS
Mark Brown (Ph.D. Thesis) 1968 54 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-199

A type of convergence of stochastic processes, convergence in linear law, is introduced. It entails convergence of finite dimensional distributions and a condition on the covariance kernels of the processes. A method is presented under which a sequence of finite collections of random variables, with suitable covariance structure, may be embedded in a sequence of continuous time processes satisfying the covariance conditions for linear law convergence. Applications to limiting distributions of linear combinations of order statistics and linear combinations of successive differences of order statistics are obtained. Limiting distributions are also obtained for certain random variables arising in nuclear chemistry and reliability. Dissert. Abstr.

N69-30829# RAND Corp., Santa Monica, Calif.
ON THE SIMPLIFICATION OF THE LINEAR APPROXIMATION PROBLEM IN HILBERT SPACE WITH APPLICATIONS TO LEAST SQUARES
Marvin Blum Sep. 1968 23 p refs
(AD-675976; P-3934) Avail: CFSTI CSCL 12/1

A method for reducing the order of a matrix inversion required in the linear approximation problem in Hilbert space has been derived. The method depends on identifying the components of the basis vectors of the approximating vectors with the members of an orthonormal sequence in the Hilbert space. The method has been applied to a number of examples in $L^{2(A,B)}$ to show how the least squares solution may be simplified by reducing the order of matrix inversion required. The main results of the paper are presented for the reduced solution in abstract Hilbert space. The specific form of the general equations has been applied to three examples in the Hilbert space $L^{2(A,B)}$ finite. Author (TAB)

N69-30832# California Univ., Los Angeles.
NONLINEAR PERTURBATIONS OF LINEAR ELLIPTIC BOUNDARY VALUE PROBLEMS AT RESONANCE
E. M. Landesman and A. C. Lazer (Case Western Reserve Univ.) [1969] 27 p refs
(Contracts Nonr-233(76); DA-31-124-ARO(D)-355)
(AD-684827) Avail: CFSTI CSCL 12/1

The existence problem for generalized solutions of the boundary value problem: $Lu + \alpha u + g(u) = h(x)$, $u(x) = 0$ on ∂D, where h is a real function in $L^2(D)$, α is a positive constant, and g is a real valued function which is bounded and continuous on the real line and satisfies an additional restriction. The existence is assumed of generalized solutions for the linear homogeneous problem: $Lu + \alpha u = 0$, $u(x) = 0$ on ∂D but it is not necessarily assumed that h is orthogonal to the solutions with respect to the usual inner product of a higher order derivative. K.R.G

N69-30838# Varian Associates, Palo Alto, Calif. Radiation Div.
A HIGH-VOLTAGE PULSE-TRAIN AMPLIFIER FOR 10-MHz LINAC BEAM MODULATION
R. F. Nylander *In* N.Y. Univ. Proc. of the 10th Modulator Symp. May 1968 p 22–40 (See N69-30833 17-09) refs
Avail: CFSTI

A vacuum tube driver for a set of deflection plates, used to produce a burst of short beam pulses during each Linac pulse cycle, is described. Problems involved in its design and assembly, as well as testing performance, are treated. This three-stage amplifier is capable of producing a 10 MHz pulse train having an amplitude of approximately 1100 V, a duty factor of 30%, and rise and fall times of less than 5 nsec with 75 ohm resistance. Zener coupling was used between stages to obtain a shift in dc potential without significant attenuation or droop. Such coupling was achieved by using pulsed plate power, which also permits the operation of one stage at much higher voltage and power levels than would otherwise be possible. A.C.R

N69-30888*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
A NEW APPROACH TO THE ANALYSIS OF LINEAR MODELS
Fred Michael Speed (Ph.D. Thesis – Tex. A&M Univ.) Jun. 1969 219 p refs
(NASA-TM-X-58030) Avail: CFSTI CSCL 12A

This dissertation analyzes linear models by writing the model in the form $Y = Xu + e$ subject to $\theta^T u = \xi$, where the usual assumptions are made about e. It is shown that for experimental design models, X^TX is always diagonal and of full rank. Included are methods to obtain θ^T for the classical design models as well as arbitrary linear models. Other topics are regression models, covariance models, estimates of fixed effects in mixed models, and a procedure for obtaining expectations, variances, and covariances for quadratic forms. Author

N69-30877 Stanford Univ., Calif.
THE ROBBINS-MONRO STOCHASTIC APPROXIMATION APPROACH TO A DISCRIMINATION PROBLEM
Martin Alva Hamilton (Ph.D. Thesis) 1968 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-227

In this paper some properties of sequential estimation procedures associated with generalized versions of discrimination equation are derived. Sufficient conditions are found for the estimates to be consistent. Conditions are given under which the estimates (properly normalized) are asymptotically normally distributed and cases for which the variance of the asymptotic distribution is minimized are described. The small sample bias and mean-square error are computed for linear. M. Dissert. Abstr.

N69-30880# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
A CLASS OF SEQUENTIAL MULTIPLE DECISION PROCEDURES
Austin M. Barron Sep. 1968 111 p refs *Its* Mimeograph Ser. No. 169
(Contract F33615-69-C-1244; NSF GP-06073)
(AD-675641) Avail: CFSTI CSCL 12/1

Consider K populations pi_1, pi_2, . . . , pi_K where each pi_i has an observable random variable which depends on some parameter $theta_i$. The problem then is to define sequential multiple decision procedures, which select a subset pi_1, pi_2, . . . , pi_K such that the population with the largest (or smallest) mean is included with a prescribed probability P^*. Two types of procedures are considered. The first is a non-eliminating type which takes observations from each population at each stage until a decision (to select or reject) has been made about all the populations. The second, an eliminating type, stops sampling from a population when a decision has been reached about that population. The first two chapters deal with normal populations when the parameters in question are the means. The last chapter offers some generalizations of the procedure and some related problems. Author (TAB)

N69-30897# California Univ., Los Angeles.
AN EXAMPLE OF A MAX-MIN PROBLEM IN PARTIAL DIFFERENTIAL EQUATIONS
Joan Cea and Kasimierz Malanowski [1969] 18 p refs
(Contract Nonr-233(76))
(AD-684826) Avail: CFSTI CSCL 12/1

The paper studies a Max-min problem. Solving explicitly the min problem, the original problem can be stated as a control problem. The state equation is a partial differential equation and the control appears only in the coefficients of the state equation. Existence and uniqueness (in a suitable sense) of an optimal problem is proved and a convergent iterative method is given to compute the solution. TAB

N69-30926 Oregon Univ., Portland.
UNIFORM ALGEBRAS AND MAXIMAL CLOSED PREPRIMES OF C(X)
Raymond William Honerlah (Ph.D. Thesis) 1968 50 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-24

The admissible preprimes are in correspondence with those complex homomorphisms on uniform subalgebras of C(X) which are not multiplicatively extendible to larger subalgebras of C(X). The class of uniform algebras possessing such homomorphisms is obtained, and it is the study of this class of algebras, which is the primary purpose of the thesis. In studying the uniform algebras associated with admissible preprimes, particular attention is given to: (1) boundaries, essential sets, and sets of antisymmetry; (2) support sets of certain representing measures; and (3) maximality conditions. In particular, such algebras are shown to possess a maximality property which has been defined and studied. Dissert. Abstr.

N69-30927 North Carolina Univ., Chapel Hill.
EXTENSIONS OF ABSTRACT VALUED SET FUNCTIONS
James Ernest Huneycutt, Jr. (Ph.D. Thesis) 1968 60 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-1624

Let M be a lattice or a half-ring of sets and μ a modular (when M is a lattice) or additive (when M is a half-ring) function on M with values in a topological group G. The problem of extending μ to a countably additive function on the smallest σ-ring containing M is considered and sufficient conditions for this extension are discussed. Countable additivity on the ring generated by M is attained by placing certain regularity conditions on μ. These conditions reduce to ordinary regularity in the case μ is a nonnegative, real-valued function and the theorems of Von Neumann (when M is a half-ring), and of Pettis (when M is a lattice) are shown to be special cases of the results. The theorems of Langlands and Dinculeanu and Kluvanek are derived. Application is made to topological group valued functions on partially ordered sets of combining works of Revuz and of Radu concerning generalized Stieltjes measures. Dissert. Abstr.

N69-30932 Carnegie-Mellon Univ., Pittsburgh, Pa.
ON THE EXISTENCE AND UNIQUENESS OF SOLUTIONS TO BOUNDARY VALUE PROBLEMS IN FINITE ELASTICITY
Wayne Van Buren (Ph.D. Thesis) 1968 82 p
Avail: Univ. Microfilms: hc $4.40/Microfilm $3.00 Order No. 68-17618

Both physical arguments and known exact solutions suggest that no general assertion of uniqueness can be expected, or even desired, except in special circumstances. However, sometimes one can expect *local uniqueness* in the sense that for sufficiently small loads there is one and only one sufficiently small solution. A local existence and uniqueness theorem for a class of traction boundary value problems in the finite theory has been proved by Stoppelli. In this thesis we clarify Stoppelli's procedure and prove local existence and uniqueness theorems for a more general class of traction problems and also for the place and mixed problems. These results, obtained under the assumption that the corresponding boundary value problem in the infinitesimal theory has a unique solution, are based on the inverse function theorem in a Banach space. Dissert. Abstr.

N69-30934 Stevens Inst. of Tech., Hoboken, N.J.
THE NUMERICAL SOLUTION OF A THIRD ORDER PARTIAL DIFFERENTIAL EQUATION
Anthony John Keeping (Ph.D. Thesis) 1968 187 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 68-16217

A partial differential equation similar to $u_{xxx} + 3u_t = 0$ arises in the study of ocean currents near the equator. This thesis discusses the numerical solution of some problems involving $u_{xxx} + 3u_t = 0$, in particular the "initial-line problem" and the "half-strip problem." The boundary condition for the initial-line problem is of the form $u(x, 0) = f(x)$ $(-\infty < x < \infty)$. The of the halfstrip problem considered in most detail here has boundary conditions of the form $u(x, 0) = f(x)$ $(0 \leq x \leq 1)$, $u(0, t) = p(t)$ $(t \geq 0)$, $u(1, t) = q(t)$ $(t \geq 0)$, $u_x(1, t) = r(t)$ $(t \geq 0)$; however, other variants are possible. Several finite-difference approximations to $u_{xxx} + 3u_t = 0$ for a rectangular grid of points are derived. Two implicit schemes are shown to be stable for all values of the step sizes; one explicit scheme is shown to be stable if the step sizes are suitably restricted. Dissert. Abstr.

N69-30935 Stanford Univ., Calif.
GYROSCOPIC DRIFTS ASSOCIATED WITH ROTATIONAL CASE MOTION
Richard Allen Wenglarz (Ph.D. Thesis) 1968 79 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-311

Exact dynamical and kinematical equations governing motions of a two-degree-of-freedom gyroscope mounted on a vehicle performing angular motions are formulated. From these equations, a set of simpler ones is derived by taking advantage of a number of experimentally verifiable facts, and procedures are developed for solving this set for vehicles performing either small or large amplitude motions. Solutions are then obtained for oscillations of small amplitude and for rotation at a constant rate. Formulas relating average drift rates to system parameters are presented, and their validity is established by comparing predictions of the theory with digital computer solutions of exact equations of motion. Dissert. Abstr.

N69-30954# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.
A UNIFIED APPROACH TO NONLINEAR ESTIMATION, OCTOBER–DECEMBER 1968
Ira A. Gura and Laurie J. Hendrikson 15 Jan. 1969 43 p refs
(Contract F04701-68-C-0200)
(AD-685161; TR-0200(4306-02)-2; SAMSO-TR-69-57) Avail: CFSTI CSCL 12/1

A unified approach to the dynamic nonlinear estimation problem is presented. General algorithms for filtering, smoothing, and prediction for both continuous and discrete nonlinear systems are derived. The continuous problem is treated first by a direct approach which yields an exact solution. A similar approach is then applied to the more complex discrete estimation problem. The discussion provided points out some subtle, but important features of the main results which should be useful when applying the results to practical problems. To provide insight, motivation and background for the technique used in obtaining the solution of the general nonlinear problem, the special case of linear estimation is discussed in the first two appendices. In a third appendix it is shown that in the continuous measurement limit, the derived discrete and continuous nonlinear filtering algorithms are identical. Author (TAB)

N69-30959# RAND Corp., Santa Monica, Calif.
REAL NUMBERS AND FUNCTIONS IN THE KLEENE HIERARCHY AND LIMITS OF RECURSIVE, RATIONAL FUNCTIONS
N. Z. Shapiro Apr. 1969 22 p refs Submitted for publication
(Contract F44620-67-C-0045; Proj. RAND)
(AD-686415; RM-5485-PR) Avail: CFSTI CSCL 12/1

Let f be a real number. It is well known that the set of rational numbers that are less than f is a recursive set if and only if f is representable as the limit of a recursive, recursively convergent sequence of rational numbers. In this study the condition that the set of rational numbers less than f is recursive is replaced by the condition that this set is at various points in the Kleene hierarchy. The recursive, recursively convergent limit is replaced by a variety of other recursive limiting processes. Author (TAB)

N69-30963# RAND Corp., Santa Monica, Calif.
AN INTRODUCTION TO THE MODEL THEORY OF FIRST-ORDER PREDICATE LOGIC AND A RELATED TEMPORAL LOGIC
Robert Mattison Sep. 1968 74 p refs
(Contract F44620-67-C-0045)
(AD-675985; RM-5580-PR) Avail: CFSTI CSCL 12/1

A self-contained introduction to the model theory of the traditional first-order predicate logic and a condensed but parallel development of the model theory of a first-order temporal logic—A formal language having greater expressive capabilities than the first-order predicate language in that it can express propositions involving tenses, dates, or quantification over temporal entities. The first-order predicate language is defined, along with its terms and formulas, and the notion of bound and free variables is explained. A set of axioms is given, together with a rule of inference, to form the first-order predicate calculus. The notions of a deduction, a theorem of logic, and a consistent set of formulas are introduced, and the deduction theorem and a form of the compactness theorem are stated and proved. The new first-order temporal language differs from the traditional one in allowing quantification over intervals and the admission of interval constants, thus enabling it to express propositions involving dates and tenses. Author (TAB)

N69-30965# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
MATHEMATICAL THEORY OF CONTROL OF NONLINEAR PROCESSES Annual Report, 1 Jan.–31 Dec. 1968
E. B. Lee Mar. 1969 9 p refs
(Grant AF-AFOSR-1502-68)
(AD-685175; AFOSR-69-0863TR) Avail: CFSTI CSCL 12/2

The research conducted during the year centered around development of analysis and synthesis techniques for controlled systems having many degrees of freedom. The models considered were primarily of the differential or differential-difference equation type. Some preliminary investigations were made when the model is of the partial differential equation type for controlled systems with distributed parameters. Specific topics considered were: (1) Stabilizing feedback controllers, (2) Optimal control, (3) Identification and realizability, (4) Large scale optimization, and (5 Simulation techniques. Author (TAB)

N69-30966 Northwestern Univ., Evanston, Ill.
C^3 CONFORMAL MAPS ON HILBERT SPACE AND THE THEORY OF CONNECTIONS
Melvyn Evans Huff (Ph.D. Thesis) 1968 72 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 69-1850

The aim is to classify C^3 conformal maps defined on open connected subsets of a Hilbert space. The theory of connections is used to demonstrate the relationship of d_f to a differential equation. The relationship of one–one C^3 conformal mapping to a hypersphere is solved as a function of H. Dissert. Abstr.

N69-30968 Houston Univ., Tex.
A COMPARISON OF COVERING PROPERTIES IN T_3 AND T_4 SPACES
Robert Cooke Briggs, III (Ph.D. Thesis) 1968 57 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-767

Weak and strong cover compactness are defined and compared with five other well-known covering properties in developable, semimetric, first countable, locally compact and general T_3 and T_4 spaces. In addition, it is shown that weak or strong cover compactness implies point-collectionwise normality in certain T_3 spaces and that this implication leads to useful results concerning subspaces, Cartesian product spaces and closed refinements. Finally, "basic" and "total" covering properties are defined, compared, and shown to insure the equivalence of large and small inductive dimension in metric spaces. Dissert. Abstr.

N69-30973 Dartmouth Coll., Hanover, N.H.
THE DECOMPOSITION OF A 3-MANIFOLD BY DISKS

Jonathan Light Gross (Ph.D. Thesis) 1968 65 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 69-390

This thesis is divided into two parts: the first part is concerned with pasting 3-manifolds together and cutting them apart across disks; the second part considers pasting them together and cutting them apart across any compact surface, still giving primary emphasis to cutting and pasting across disks. Dissert. Abstr.

N69-30974 Northwestern Univ., Evanston, Ill.
TRANSFORMATIONS OF UNIFORM AND STATIONARY POINT PROCESSES
Robert Allan Agnew (Ph.D. Thesis) 1968 60 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-1782

Point processes defined on a locally compact, sigma-compact Hausdorff space are investigated. Uniformity of a point process with respect to a Borel measure is defined, and some characterizations for uniform point processes are given. In particular, Bernoulli and Poisson processes are introduced as special cases of uniform point processes defined on countable and uncountable spaces respectively. Stationarity of a point process defined on a locally compact, sigma-compact, commutative topological group is also characterized. The behavior of uniform and stationary point processes under certain transformations is characterized with particular emphasis on special cases where uniformity and stationarity are preserved. The transformations introduced are superposition, decomposition, point maps from one space to another, and random translations on a topological group. Dissert. Abstr.

N69-30977 North Carolina Univ., Chapel Hill.
STIELTJES-VOLTERRA INTEGRAL EQUATIONS
Carl Wilfrid Bitzer (Ph.D. Thesis) 1968 67 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-1580

The S denotes a linearly ordered set, N denotes a complete normed ring with unity, I denotes the identity function whose range of definition is clear from the context, and F denotes a certain class of functions from $S \times S$ to N. If each of f and g is a function from $S \times S$ to N and [a,b] is an interval of S then the integral (I) $\int_a^b df \cdot g$ is defined in the manner of successive refinements of subdivisions of [a,b] with $[f(s_p) - f(s_{p-1})] \cdot g(s_{p-1})$ being a typical term in the approximating sum. The class of all functions in F which are continuous in their first place and the class of all functions in F which are uniformly continuous on each square of $S \times S$ are invariant under H. Similar results hold for the nonhomogeneous case. Dissert. Abstr.

N69-30979# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
A NEW PROBABILITY DISTRIBUTION FUNCTION WITH PARAMETER-NOMOGRAM, TABLES, AND APPLICATIONS
Robert N. Braswell and Clara F. Manders Feb. 1969 44 p refs
(Contract DAHC04-68-C-0002; Proj. Themis)
(AD-684809; TR-12) Avail: CFSTI CSCL 12/1

The objective of this paper is to introduce a flexible finite range probability distribution function, FRPDF. Knowledge of the probability distribution of a random variable is required before a statistical decision can be made with regard to a certain action. Author (TAB)

N69-30982 Illinois Univ., Urbana.
STRUCTURE IN FINITE GRAPHS
Kenneth Brooks Reid, Jr. (Ph.D. Thesis) 1968 111 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-1419

Mainly this thesis is concerned with questions about tournaments in the vein of Erdös, Harary, Moser, and Moon, but ordinary graphs and digraphs are considered in various parts. Following an introduction and a section of definitions, measures of transitivity in tournaments are treated. A proof that every tournament of order 15 contains a transitive subtournament of order 5 is given. This is the basis for an infinite number of counterexamples to a conjecture of P. Erdös and L. Moser concerning the largest transitive subtournament of a tournament. A lower bound of P. Erdös and J. W. Moon is improved for the number of consistent arcs in a tournament (a set S of consistent arcs of a tournament is a set of arcs of the tournament such that no oriented cycle of the tournament is composed entirely of arcs of S). Thus, these two sections provide additional information on how transitive a tournament may be. Dissert. Abstr.

N69-31013 Illinois Univ., Urbana.
ON THE USE OF FINITE FIELD BASED MODELING IN POLYNOMIAL MANIPULATION
Stephen John Nuspl (Ph.D. Thesis) 1968 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-1402

A major hindrance to the manipulation of polynomials by a computer is the rapid growth of the polynomial coefficients during the application of some frequently used algorithms. The methods presented in this thesis to try to alleviate this problem and to increase the efficiency of polynomial manipulation are based on the use of algebraic redundancy. Let I_0 be the set of all integers and I_{j+1} be the adjunction of I_j consisting of the set of all polynomials in x_{j+1} with coefficients in I_j. Let F_0 be a field of order p_0 where p_0 is a prime in I_0. The extension field F_{j+1} is defined to be the set of residues in $F_j[x_{j+1}]$ modulo p_{j+1}, a monic irreducible polynomial in $F_j[x_{j+1}]$. The sets I_j are defined as the modeled domains and the sets F_j and their adjunctions as the model domains. A modeling function which maps any element of a modeled domain into any one of the model domains is defined and shown to be a homomorphism. Dissert. Abstr.

N69-31019 California Inst. of Tech., Pasadena.
BOUNDARY VALUE PROBLEMS FOR STOCHASTIC DIFFERENTIAL EQUATIONS
Thomas William Mac Dowell (Ph.D. Thesis) 1968 86 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-525

A theory of two-point boundary value problems analogous to the theory of initial value problems for stochastic ordinary differential equations whose solutions form Markov processes is developed. The theory of initial value problems consists of three main parts: the proof that the solution process is markovian and diffusive; the construction of the Kolmogorov or Fokker–Planck equation of the process; and the proof that the transition probability density of the process is a unique solution of the Fokker–Planck equation. It is assumed here that the stochastic differential equation under consideration has, as an initial value problem, a diffusive markovian solution process. Since a boundary value problem, unlike an initial value problem, has no preferred direction for the parameter set, two Fokker–Planck equations were found one for each direction. It is shown that the density of the solution process of the boundary value problem is the unique simultaneous solution of this pair of Fokker–Planck equations. Dissert. Abstr.

N69-31020 Washington Univ., Seattle.
SOME RESULTS ON THE UNIQUENESS OF TRIGONOMETRIC SERIES IN A CLASS OF COMPACT ABELIAN GROUPS

Clark Edward Runnion (Ph.D. Thesis) 1968 83 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-1211

Let G be a countable product of finite cyclic groups whose orders have a uniform bound. When given the product topology G becomes a metrizable compact Abelian group. As such, its character group is countable. An ordering is imposed on this character group and trigonometric series with respect to this ordering are analyzed. The ordering used has several natural properties which are demonstrated. The natural identification of G as a measure space allows us to compute indefinite integrals of the characters of G. Properties of termwise integrals of trigonometric series are related to those of the series itself. The results pave the way for showing that every countable subset of G is a set of uniqueness.
Dissert. Abstr.

N69-31021 National Bureau of Standards, Boulder, Colo. Radio Standards Physics Div.
MATHEMATICAL TECHNIQUES FOR EPR ANALYSIS OF S EQUALS 5/2 IONS IN C SUB 2 SYMMETRY. APPLICATION TO Fe SUP 3 SUP PLUS IN QUARTZ
R. L. Peterson, L. M. Matarrese, and J. S. Wells Jun. 1969 27 p refs
(NBS-TN-372) Avail: SOD $.35

Various formulas and mathematical techniques useful for the analyses of the EPR spectra of ions of angular momentum 5/2 in sites of C_2 symmetry are presented. Special emphasis is given to the spectrum of Fe^{3+} in synthetic brown quartz. Included are: matrix elements of the Racah operators for arbitrary direction of the axis of quantization relative to the crystalline electric field axes, spectral line position formulas based upon a usage of second-order perturbation theory which is somewhat different from the usual, and line intensity formulas.
Author

N69-31022 Stanford Univ., Calif.
ON THE COMPUTATIONAL COMPLEXITY OF FINITE FUNCTIONS
Philip Martin Spira (Ph.D. Thesis) 1968 71 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 69-295

The computational complexity of finite functions is an area of much current interest to automata theorists. In this thesis we are concerned with the minimum time of computation for such functions by means of circuits of logical elements each having unit delay, at most r(>1) input lines, one splittable output line, and with each line carrying values from the set $Z_d = \{0,1,\ldots,d-1\}$. These are called (d,r) circuits. A principal contribution of this thesis is a complete determination of the time necessary to compute multiplication in a finite group with a (d,r) circuit. Then a novel method of circuit synthesis for group multiplication is given. In contrast to previous procedures, it is valid for any finite group, Abelian or not. It is completely algebraic in character and is based upon our result that any finite group has a family of subgroups having a trivial intersection and minimum order quantity.
Dissert. Abstr.

N69-31023 North Carolina Univ., Chapel Hill.
MAJORITY DECODABLE CODES DERIVED FROM FINITE GEOMETRIES
Kempton John Cameron Smith (Ph.D. Thesis) 1968 116 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-1680

A number of q-ary cyclic error-correcting codes to which a majority decoding algorithm is applicable may be called geometric codes in that the incidence vectors of certain flat spaces in the finite projective geometry PG(t,q) or the finite affine geometry EG(t,q) are vectors of the dual code. Such geometric codes are related to incidence matrices of points and d-flats in the corresponding geometry. An upper bound is given for the rank of these incidence matrices over GF(q). Exact results are obtained for the case $d = t-1$ and for the case $d \leq t-1$ and prime q. Some known geometric cyclic codes are reviewed and several new classes of such codes are constructed. Tables are given which list the parameters of some of the new codes. One-step and multi-step majority decoding algorithms for geometric codes are given. A formula for the number of information symbols in certain Generalized Reed-Muller codes is derived.
Dissert. Abstr.

N69-31025 Columbia Univ., New York.
TOPOLOGIES AND BOREL STRUCTURES ASSOCIATED WITH BANACH ALGEBRAS OF FUNCTIONS
Phyllis Rubin Strauss (Ph.D. Thesis) 1968 143 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-569

The ideas and notation are motivated by the pseudocompact and realcompact, and related concepts. Many relations involving these concepts are then simply explained by introducing a new topology. Earlier treatments of the notions realcompact and pseudocompact correspond to the special case when B is the algebra $C^*(E)$ of all bounded β-continuous functions on E. These structures and relations, which can be described using sequences of functions and countable sets, are extended to nets and sets of cardinality.
Dissert. Abstr.

N69-31034 University of Southern Calif., Los Angeles.
DOUBLY-TIMELIKE GENERAL G-SPACES
Peter Yam-Poon Woo (Ph.D. Thesis) 1968 116 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-653

The time inequality for triangles in the large is proved for any subset of a doubly-timelike space in which the path between two points is unique. If the space is geodesically complete, then in each pair of opposite quadrants at a point, either all the geodesics through the point are circles of the same length or each is isometric to the real line. It is impossible that all geodesics through a point are circles. It follows that such a space is homeomorphic to either a Möbius band or a plane. If the geodesics can be represented by portions of affine lines, then the space is called Desarguesian, and a necessary and sufficient condition for a Desarguesian straight plane to be Minkowskian is that each circle of the space, which always consists of four branches in each quadrant of its center, is concave, and that the parallel axiom is true. To prove this last theorem, a theory of perpendiculars, asymptotes, limit circles, and parallels is developed, and many basic properties analogous to those in G-spaces are proved.
Dissert. Abstr.

N69-31035 Maryland Univ., College Park.
NORMAL BASES OF AMBIGUOUS IDEALS AS GALOIS MODULES
Stephen Virgil Ullom (Ph.D. Thesis) 1968 115 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-727

The theory of root numbers associated with a normal basis of the ring of integers of a certain cyclic extension of the rationals is generalized to apply to normal bases of ambiguous ideals. Explicit normal bases are given for all ambiguous ideals with normal bases in quadratic extensions of the rationals and the Gauss field. For extensions of local fields with finite residue class fields where the degree of the extension does not divide the characteristic of the residue class field, given are necessary and sufficient conditions for an ambiguous ideal to have a normal basis.
Dissert. Abstr.

N69-31070# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
ELLIPSOIDAL BOUNDS FOR THE SOLUTIONS OF SYSTEMS OF ORDINARY LINEAR DIFFERENTIAL EQUATIONS
Karl G. Guderley and Charles L. Keller Jan. 1969 115 p refs
(AD-686425; ARL-69-0005) Avail: CFSTI CSCL 12/1

An approximate solution for a linear system of ordinary differential equations will fail to satisfy this system by some quantity called the residual. The present report derives a method for determining bounds for the error of the approximate solution from bounds on the residual. The residual and the error are characterized as vectors which lie inside and on the surface of ellipsoids. For an nth order system these ellipsoids are given by symmetric positive definite quadratic forms determined by matrices. The matrix for the residual is assumed given. A differential inequality is derived from which the matrix for the error ellipsoid is computed. The narrowness of the error bounds so obtained is studied on a theoretical basis. Author (TAB)

N69-31072 Pittsburgh Univ., Pa.
THE Z(p,q) AND RELATED TRANSFORMATIONS DEFINED ON SETS OF BOUNDED DOUBLE SEQUENCES
William Aaron Markley, Jr. (Ph.D. Thesis) 1968 54 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-16629

The definitions of the Shannon entropy, Rényi entropy, and more generally the Daróczy (p,q)-entropy of a finite σ-field F are given. The properties of each of these entropies are listed, and those properties which are common to all of these entropies are noted. The concept of conditional Shannon entropy is defined, and several of the important properties of this conditional entropy are stated. Using the Daróczy entropy of order (p,q) of F, the conditional Daróczy entropy of F given B of order (p,q), $H_{p,q}^{B}(F)$, is defined by using B-conditional probabilities in place of absolute probabilities and taking the expected value. It is shown that conditional Daróczy (p,q)-entropy does not in general satisfy the useful additivity property of conditional Shannon entropy. Dissert. Abstr.

N69-31073 Virginia Univ., Charlottesville.
CONDITIONAL DAROCZY ENTROPY
Roger William Allen, Jr. (Ph.D. Thesis) 1968 61 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 68-18174

Transformations defined on sets of bounded double sequences are studied using positive integers and positive real numbers. Nörlund transformations with generating functions are used in finding necessary and sufficient conditions for transforming all regularly convergent sequences into almost convergent double sequences. Two other classes of related double sequence summability methods are studied for positive integers. Definitions are given for periodic, ultimately periodic, semiperodic and ultimately semiperiodic sequences, and sets of double sequences that are compositions of perfectly convergent sequences are studied. Dissert. Abstr.

N69-31075*# Rice Univ., Houston, Tex.
THE RESTORATION OF CONSTRAINTS IN NONHOLONOMIC PROBLEMS: NUMERICAL EXAMPLES
John N. Damoulakis 1969 34 p refs
(Grant NGR-44-006-089)
(NASA-CR-103210; AAR-57) Avail: CFSTI CSCL 12A

In previous papers, an iterative procedure was developed in order to restore the differential constraints describing a system. The procedure involved quasi-linearization with an added optimality conditon, namely, the requirement of least-square change of the control and the state. In the present paper, this procedure is applied to solve several restoration problems. The restoration is performed by minimizing the integral. Numerical examples are developed for three values of the weighting coefficient. It is shown that the procedure restores the constraints to the same degree of accuracy in the same number of iterations. The rapidly converging characteristics of the algorithm described previously is demonstrated. Author

N69-31088# Pennsylvania State Univ., University Park. Ordnance Research Lab.
BOUNDS ON TRUNCATION ERROR FOR THE CARDINAL SAMPLING EXPANSION
H. S. Piper Washington Naval Ordnance Systems Command 8 Nov. 1968 100 p refs
(Contract Now-65-0123-d)
(AD-684887) Avail: CFSTI CSCL 12/1

It is well-known that a function bandlimited to (-pi, pi) and having a Fourier transform which is either square integrable or absolutely integrable can be represented exactly for all time by an infinite series involving the sample values of the function at the integer points. If the summation involves only a finite number of terms, then an approximation to the bandlimited function is obtained. We define the difference between the given function and the finite approximation to it as a truncation error. Studies concerning bounds on the magnitude of the truncation error are reported here. Author (TAB)

N69-31128 Northwestern Univ., Evanston, Ill.
MODULES OF FINITE WIDTH
Michael Howard Wichman (Ph.D. Thesis) 1968 38 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-1966

The elementary properties of modules of finite width are established, with particular attention paid to a reduction to the local case. It is shown that every module of finite width over a Noetherian ring is countably generated. The question as to whether or not the existence of a faithful torsion R-module of finite width implies that R must have a finite width is also investigated. Finally, a faithful torsion R-module of width one over a local Noetherian domain is shown to be S-isomorphic to Q/S; where S is a valuation ring dominating R, and Q is the quotient field of S. Dissert. Abstr.

N69-31159 Maryland Univ., College Park.
THE SOLUTION OF SOME SINGULAR CAUCHY PROBLEMS
Jay Murrie Solomon (Ph.D. Thesis) 1968 106 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-723)

A transformation (correspondence principle) is developed for singular Cauchy problems which transforms the operator of one problem into an operator of another, and transforms a solution of the first problem into a solution of the second problem. This transformation is applied to a problem associated with a certain sequence of operators which are related to some of the Huygens' operators recently found by Lagnese and Stellmacher. Explicit representations of the solution are obtained and their Huygens' property is discussed. Dissert. Author

N69-31176# California Univ., Los Angeles. Numerical Analysis Research.
EXISTENCE THEOREMS IN PROBLEMS OF OPTIMIZATION: ONE AND MORE DIMENSIONAL PROBLEMS
Lamberto Cesari [1969] 165 p refs
(Contracts Nonr-233(76); DA-31-124-ARO(D)-355)
(AD-684828) Avail: CFSTI CSCL 12/1

The canonic problem of optimisation of real variables of space, control, and time is presented. Analogous definitions for

absolute maxima are discussed. The existance theorem for one-dimensional Mayer, Lagrange, and free problems are reported as well as the implicit function theorem and the closure theorem. J.A.M.

N69-31199 Oregon Univ., Eugene.
FINITE PRIMES IN SIMPLE ALGEBRAS AND INFINITE PRIMES IN FIELDS
Hoyt Dinsmore Warner (Ph.D. Thesis) 1968 64 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 69-52

Proof is given that for a noncommutative finite dimensional simple algebra, there exists a set of finite primes which are finitely generated modules over a ring. As in the commutative case, the finite primes determine the classical arithmetic theory of the algebra. It is shown that the space of all finite primes of a noncommutative finite dimensional simple algebra has a dense, irreducible subset of primes. Necessary and sufficient conditions are stated for all primes of a noncommutative finite dimensional simple algebra, and special properties of infinite primes of a field determining a complex place of finite primes are given. Dissert. Abstr.

N69-31213# Atomic Energy Establishment, Winfrith (England).
MOCUP: A MONTE CARLO PROGRAMME FOR ESTIMATING RESONANCE ESCAPE IN COMPLEX GEOMETRIES
G. W. Bannister, J. C. Basher, and I. C. Pull 1968 74 p refs
(AEEW-R-243) Avail: CFSTI; HMSO 9s

MOCUP is a Monte Carlo program written for the IBM 7090 computer in FAP, the symbolic machine language. The code has been used primarily for estimating resonance escape probability and its variation with temperature in a variety of reactor systems. It has also been used as a test-bed for the development of a new Monte Carlo treatment of thermal neutron scattering. Features of the program are the geometrical complexity it can handle, including bundles of fuel rods and other rods of different types arbitrarily placed in the coolant channel, and the fine detail of the tabulated resonance data which can be accepted. The capabilities of the code, data preparation, results available, operational features and Monte Carlo methods embodied in the program are described. Author (NSA)

N69-31229# Boeing Scientific Research Labs., Seattle, Wash.
RATIONAL ARITHMETIC WITH INTEGERS OF INDEFINITE LENGTH
Arnold Rom Feb. 1969 131 p
(AD-686324; D1-82-0807) Avail: CFSTI CSCL 9/2

A software package for performing rational arithmetic with integers of indefinite length has been made available. The package can also be used to carry out multiple precision fixed point arithmetic. The routines are coded in 360/44 assembly language but can be called from FORTRAN. A scheme for dynamic storage allocation is described. Author (TAB)

N69-31258# Stanford Univ., Calif. Dept. of Statistics.
LIMIT PROCESSES FOR SPECTRAL DISTRIBUTION FUNCTIONS WITH APPLICATION TO GOODNESS-OF-FIT TESTING
Ian Bruce Mac Neill 3 Mar. 1969 166 p refs
(Contract DA-ARO(D)-31-124-G1077)
(AD-686320; TR-27; AROD-2025.27-M) Avail: CFSTI CSCL 12/1

The limits in distribution of the sequences of stochastic processes defined by the deviations of the sample co-spectral and quadrature spectral distribution functions are found using the theory of convergence in distribution of stochastic processes. Our study requires that the limiting central moments be found and, since we carry out our derivations entirely in the spectral domain, we require a discussion of certain kernels that arise in the computation of these moments. The limit processes are shown to be Gaussian with independent increments and with covariances defined in terms of the hypothesized spectral densities. The distributions of certain functionals on these limit processes are computed. The functionals include Cramer-Von Mises, Watson and Kuiper-type statistics as well as the Smirnov and Kolmogorov-type statistics. These results are used to obtain the limiting distribution of goodness-of-fit tests of the types mentioned above for the co-spectral and quadrature spectral distribution functions. Normalized spectral distribution functions are also considered. Author (TAB)

N69-31268# Oak Ridge National Lab., Tenn.
MATHEMATICS DIVISION Annual Progress Report, Period Ending 31 Dec. 1968
Manuel Feliciano, Jr., comp. and C. W. Nestor, Jr., comp. Mar. 1969 116 p refs
(Contract W-7405-ENG-26)
(ORNL-4385) Avail: CFSTI

An annual progress report is presented on mathematics and computer operations and mathematical statistics at ORNL during the period ending December 31, 1968. Topics include mathematical research, computer applications, systems programming, computer operations, and mathematical statistics. NSA

N69-31273# Gulf General Atomic, San Diego, Calif.
SAFE-2D: A COMPUTER PROGRAM FOR THE STRESS ANALYSIS OF PLANE AND AXISYMMETRIC COMPOSITE STRUCTURES A User's Manual
D. C. Cornell 12 Feb. 1969 45 p ref. Prepared for Union Carbide Nucl. Co., Oak Ridge, Tenn.
(Contract W-7405-eng-26)
(GA-9076) Avail: CFSTI

Input instructions of a computer program for the elastic analysis of heterogeneous plane and axisymmetric structures, hereafter called two-dimensional structures, are outlined. Plane structures are described in a Cartesian (x-y) coordinate system and can be in a condition of plane stress or plane strain. Axisymmetric structures involving axisymmetric stress states are described in the cylindrical coordinate system r-θ-z. A geometry which is part plane and part axisymmetric can be combined in a single analysis in which the axisymmetric part is treated isotropically and the plane part is treated orthotropically with no stiffness in the hoop direction. The program, SAFE-2D, is written in the FORTRAN 4 language and compiled for the Univac-1108 digital computer. Author (NSA)

N69-31283# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
OPTIMIZATION USING CONJUGATE GRADIENT METHODS
Shiva S. Tripathi and Kumpati S. Narendra May 1969 22 p refs
(CT-27) Avail: Issuing Activity

Solutions of systems of linear algebraic equations of the matrix and vector type are reviewed. Algorithms for the solution of a conjugate gradient method used to generate specific vector sequences was proposed. The method (OCG), operational conjugate method, using two algorithms accomplished the minimization of a quadratic function, and established complete convergence in a positive definite and bounded function. The parameter and control function optimization problems were generalized by the OCG method and the latter could be used to identify dynamical system

parameters from observed outputs. The suitability of this method for computer simulation was documented. M.H.E.

N69-31287# Cornell Univ., Ithaca, N.Y. Dept. of Operations Research.
ESTIMATION OF ORDERED PARAMETERS
Edward J. Dudewicz Feb. 1969 160 p refs Prepared in cooperation with Rochester Univ.
(Contracts Nonr-401(53); N00014-68A-0091; Grants NSF GP-7798; NSF GP-8958)
(AD-684888; TR-60) Avail: CFSTI CSCL 12/1

The problem of point estimation is considered for a location parameter family, and the bias of certain natural estimators is studied; a minimax estimator is found for certain cases. These general results are examined in the normal density case, for which additional results are obtained. The problem of strong consistency is considered for a location parameter family, and applications to value-estimation and Bayesian statistics are noted. For a location parameter family, bounds are obtained on the mean squared error of certain natural estimators. These results are examined in the normal density case, and additional bounds on the infinum and supremum of the mean squared error lead to intervals on these two quantities. Maximum likelihood estimators are studied for the normal density case. A concept of iterated maximum likelihood estimators is introduced and discussed. Generalized maximum likelihood estimators and maximum probability estimators are found. The problem of interval estimation is formulated. For a location parameter family upper and lower intervals are found, and it is shown that exact upper intervals satisfying mild conditions do not exist. Author

N69-31303*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE SHAPE PRESERVING EXPANSION AND CONTRACTION OF OBJECTS IN E^3
P.D. Argentiero Washington Jul. 1969 41 p refs
(NASA-TN-D-5240) Avail: CFSTI CSCL 12A

Several theorems are given relating the geometric structure of X to the fashion in which S(X) is topologically and algebraically imbedded in C(X). It is shown that an arc in E^N is a regular Euler set if, and only if, it is a generalized logarithmic spiral. This is a generalization of a classical result obtained by Euler. Also, a proof is given that a subset of E^3 is a regular Euler set if, and only if, it can be represented as the union of a family of logarithmic spirals. Author

N69-31311*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
LAGRANGIAN MULTIPLIERS FOR VARIATIONAL PROBLEMS AND ISOCHRONOUS DERIVATIVES IN THE GRAVITATIONAL FIELD OF AN AXISYMMETRICAL PLANET [LAGRANZHEVY MNOZHITELI VARIATSIONNOY ZADACHI I IZOKHRONNYYE PROIZVODNYYE V POLE PRITYAZHENIYA OSESIMMETRICHNOY PLANETY]
V. S. Novoselov Washington NASA Jul. 1969 16 p refs Transl. into ENGLISH from Russian Repr.
(Contract NASw-1692)
(NASA-TT-F-12297) Avail: CFSTI CSCL 12A

The expressions of Lagrangian multipliers of variational problems and isochronous derivatives of unperturbed Keplerian elements in the gravitational field of an axisymmetrical planet are studied. Author

N69-31325# Stanford Univ., Calif. Operations Research Dept.
MULTIPLE CHANNEL QUEUES IN HEAVY TRAFFIC
Donald L. Iglehart and Ward Whitt Mar. 1969 57 p refs
(Contracts N00014-67-A-0112-0031; Nonr-225(53); Grant NSF GP-8790)
(AD-686159; TR-3; TR-118) Avail: CFSTI CSCL 12/2

Queueing systems with r arrival channels and s service channels are studied under the condition of heavy traffic; traffic intensity greater than or equal to one. Limit theorems are obtained for the random functions induced in D(0,1) by the following processes: total queue length, queue length at the ith server, total load, load at the ith server, virtual waiting time, waiting time of the nth arrival, number of departures, time of the nth arrival, and the time of the nth departure. Also limit theorems for certain functionals of the above processes are obtained as an immediate consequence of weak convergence. TAB

N69-31328# Illinois Univ., Urbana. Coordinated Science Lab.
NUMERICAL STUDIES OF THE NON-LINEAR BOLTZMANN EQUATION. PART 2: STUDIES OF NEW TECHNIQUES OF ERROR REDUCTION
B. L. Hicks, S. M. Yen, and B. J. Reilly Apr. 1969 28 p refs
(Contracts N00014-67-A-0305; DAAB07-67-C-0199)
(AD-686375; R-412) Avail: CFSTI CSCL 20/13

Since 1963 a number of techniques have been developed for improving the accuracy and stability of Nordsieck Monte Carlo method of evaluating the Boltzmann collision integral. The report summarizes all of the techniques, including the older ones that have already been described in our reports and papers and the newer ones which we have been using during the past year but which have not previously been discussed in detail. Some of the techniques are numerical corrections of the Monte Carlo method and some are new and more effective implementations of it. TAB

N69-31334*# California Univ., Berkeley. Electronics Research Lab.
TESTING FUNCTION TECHNIQUES IN SYSTEM IDENTIFICATION
Ronald Marshall Bass 12 May 1969 141 p refs
(Grant NGL-05-003-016)
(NASA-CR-103289; ERL-69-3) Avail: CFSTI CSCL 12A

The following general problem was investigated: identify a linear time-invariant differential system from observations of input and output signals, over which the observer is assured to have no control. The observations of either the input or the output signals, but not both, may be corrupted by additive zero mean noise. Moments of the observed signals with derivatives of functions called "testing functions" are calculated simply by multiplying the observed signal times a derivative of a testing function and integrating the product; thus the calculation is very stable numerically. The question of what constitutes a good testing function is investigated. This method may be applied to systems of the Hammerstein form, i.e., a memoryless nonlinearity followed by a linear plant. In this case the nonlinearity is represented as a linear combination of known functions, and the coefficients of this combination as well as the coefficients of the linear plant are identified. Author

N69-31348# Oak Ridge National Lab., Tenn.
LECTURE SERIES IN STATISTICS AND PROBABILITY
J. J. Beauchamp, ed. Mar. 1969 161 p refs
(Contract W-7405-ENG-26)
(ORNL-4347) Avail: CFSTI

Topics include probability, random variables, and distribution functions; characterizations and limit theorems; contingency tables; confidence regions; distribution-free tests; linear regression; nonlinear estimation; analysis of variance; design of experiments and response surface methodology; and elements of stochastic processes. NSA

N69-31386# California Univ., Los Angeles. Western Management Science Inst.
ELEMENTS OF LARGE-SCALE MATHEMATICAL PROGRAMMING
Arthur M. Geoffrion Dec. 1968 89 p refs *Its* WMSI Working Paper-144
(Grant NSF GP-8740)
(AD-686395) Avail: CFSTI CSCL 12/2

A framework of unifying concepts is developed which comprehends much of the literature on large-scale mathematical programming. The concepts are of two types: problem manipulations and solution strategies. The principal manipulations discussed are Projection, Inner Linearization, Outer Linearization, and the principal strategies are Piecewise, Restriction, and Relaxation. Numerous algorithms are classified according to the manipulation/strategy pattern they can be viewed as using, and the validity of the framework is demonstrated by using it to reconstruct several algorithms in detail. Author (TAB)

N69-31385*# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.
BIBLIOGRAPHY ON TECHNIQUES FOR SOLVING PARTIAL DIFFERENTIAL EQUATIONS BY HYBRID COMPUTATION AND OTHER METHODS
David L. Finn 22 Apr. 1968 44 p refs
(Contract NAS8-2473)
(NASA-CR-102218; GIT/EES-A588/T16; TN-16) Avail: CFSTI CSCL 12A

This bibliography is related to the numerical solution of partial differential equations. The references are listed under three headings: hybrid computer methods, analog computer methods, and general methods. Brief comments are given for most of the references on hybrid computer methods. Author

N69-31445# State Univ. of New York at Buffalo. Div. of Interdisciplinary Studies and Research.
SIMILARITY SOLUTIONS TO SOME NONLINEAR IMPACT PROBLEMS
D. B. Taulbee, F. A. Cozzarelli, and C. L. Dym Dec. 1968 47 p refs
(Contract Nonr-4449(00))
(AD-686403; Rept-35) Avail: CFSTI CSCL 20/11

Impact and wave propagation problems are considered for nonlinearly viscous and nonlinearly elastic materials. The governing partial differential equations are reduced to ordinary differential equations by means of similarity transformations. The resulting nonlinear two point boundary value problems are then, in general, integrated numerically, although some closed form solutions are presented. Author (TAB)

N69-31448*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
APPROXIMATE ANALYTICAL SOLUTION FOR EQUATIONS IN PROBLEMS OF QUANTUM MECHANICS [PRIBLIZHENNOYE ANALITICHESKOYE RESHENIYE URAVNENIY V ZADAZHAKH KVANTOVOY MEKHANIKI]
I. V. Amirkhanov *et al* Washington NASA Jan. 1969 9 p refs Transl. into ENGLISH of Russian Rept. JINR-P4-3741
(Contract NASw-1692)
(NASA-TT-F-12079; JINR-P4-3741) Avail: CFSTI CSCL 12A

The possibilities of obtaining an approximate analytical solution for integral, differential, and intergro-differential equations are examined. One method is described in terms of a separation of terms in integro-differential equations which satisfy the condition $\int |F(t)|^2 dt < \infty$ and a subsequent Fourier expansion of them. This approach was found to be very useful in proving the convergence of the reduction method, among others. Author

N69-31455# California Univ., Berkeley. Dept. of Mathematics.
RESEARCH IN THE ALGEBRAIC THEORY OF MACHINES Final Report, 1 Feb. 1968–31 Jan. 1969
John L. Rhodes Mar. 1969 10 p
(Grant AF-AFOSR-1477-68)
(AD-686102; AFOSR-69-0974TR) Avail: CFSTI CSCL 12/1

Research on the theory of finite semigroups and finite state machines proceeded along three general lines: (a) Towards axiomitizing complexity - this being the goal of the work on the fundamental lemma of complexity. (b) Developing lower bounds to complexity in terms of the subsemigroup structure of a semigroup. (c) The development of the theory of p-length for finite semigroups. The report discusses the accomplishments in these three areas to date. Author (TAB)

N69-31496*# Rice Univ., Houston, Tex. Aero-Astronautics Group.
MATHEMATICAL PROGRAMMING FOR CONSTRAINED MINIMAL PROBLEMS. PART 1: SEQUENTIAL GRADIENT-RESTORATION ALGORITHM
A. Miele and J. C. Heideman 1969 32 p refs
(Grant NGR-44-006-089)
(NASA-CR-103287; AAR-59) Avail: CFSTI CSCL 12A

The problem of minimizing a function f(x) subject to a constraint $\phi(x) = 0$ is considered. Here, f is a scalar, x is an n-vector, and ϕ is a p-vector. An iterative algorithm is presented, made up of the alternate succession of gradient phases and restoration phases. In the gradient phase, the first-order change of f is minimized subject to the linearized constraint and a quadratic constraint on the displacement Δx. In the restoration phase, the displacement modulus $|\delta x|$ is minimized subject to the linearized constraint. It is shown that, if α is the stepsize of the gradient phase, $\Delta x = O(\alpha)$ and $\delta x = O(\alpha^2)$. Therefore, for α sufficiently small, the restoration algorithm preserves the descent property of the gradient algorithm: the function f decreases between any two successive restoration phases. Author

N69-31504# Wisconsin Univ., Madison. Mathematics Research Center.
A GLOBAL THEORY FOR LINEAR QUADRATIC DIFFERENTIAL GAMES Technical Summary Report
D. L. Lukes and D. L. Russell Jul. 1968 45 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-686132; MRC-TSR-915) Avail: CFSTI CSCL 12/2

The paper analyses a class of many player nonzero-sum linear games in Hilbert space with quadratic cost functionals. The existence and stability of equilibrium strategies is studied. The results are then applied to differential games and a feedback synthesis of the equilibrium strategies is developed. Author (TAB)

N69-31505# Wisconsin Univ., Madison. Mathematics Research Center.
A PROGRAM FOR THE SOLUTION OF DIFFERENTIAL EQUATIONS USING INTERNAL ARITHMETIC (DIFEQ) Technical Summary Report
J. A. Braun and R. E. Moore Jun. 1968 67 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-686128; MRC-TSR-901) Avail: CFSTI CSCL 12/1

A practical implementation of the techniques of interval analysis developed by Professor R. E. Moore is described for solving systems of differential equations on the CDC 3800 and 1604. Author (TAB)

N69-31508# Wisconsin Univ., Madison. Mathematics Research Center.
LIESE: A PROGRAM FOR ORDINARY DIFFERENTIAL EQUATIONS USING LIE-SERIES Technical Summary Report

H. Knapp and G. Wanner Jun. 1968 66 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-686126; MRC-TSR-881) Avail: CFSTI CSCL 12/1

The program, which is written in double precision FORTRAN, computes the solutions of ordinary differential equations using LIE-series. If wanted, also the corresponding connection matrix can be obtained. Its subroutines may be used for the automatic generation of TAYLOR-coefficients as well as for the calculation of the JACOBIAN of a system of functions. Author (TAB)

N69-31507# Wisconsin Univ., Madison. Mathematics Research Center.
ON N-WIDTHS IN SOBOLEV SPACES AND APPLICATIONS TO ELLIPTIC BOUNDARY VALUE PROBLEMS Technical Summary Report
Joseph W. Jerome Aug. 1968 26 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-686133; MRC-TSR-917) Avail: CFSTI CSCL 12/1

A characterization of n-widths in Sobolev spaces is given and applications made to eigenvalue and boundary value problems. Author (TAB)

N69-31508# Wisconsin Univ., Madison. Mathematics Research Center.
HARMONIC ANALYSIS ON CERTAIN VECTOR SPACES Technical Summary Report
J. Kuelbs and V. Mandrekar Jun. 1968 49 p refs
(Contract DA-31-124-ARO(D)-462; GRANT NSF GP-7181)
(AD-686129; MRC-TSR-902) Avail: CFSTI CSCL 12/1

Let l denote the vector space of all sequences of real numbers with the topology of coordinate-wise convergence. For 0 < p < infinity l sub p denote the subset of l consisting of all sequences x sub i which have the summation, from one to infinity of the (absolute value of x sub i) to the p power finite. The main efforts in the paper are to generalize Bochners theorem and the Levy-continuity theorem to these l sub p spaces. Author (TAB)

N69-31519# Wisconsin Univ., Madison. Dept. of Statistics.
EFFECT OF NON-NORMALITY ON INFERENCES ABOUT VARIANCE COMPONENTS
G. C. Tiao and M. M. Ali Nov. 1968 36 p refs
(Grant DA-ARO(D)-31-124-G917)
(AD-686295; TR-185) Avail: CFSTI CSCL 12/1

Bayesian methods are used to analyse the one-way random effect model y sub ij = mu + a sub i + e sub ij in which e sub ij are assumed normal, N(0, sigma squared sub e), and a sub i are assumed to have a mixture of two normals, .95N(-.05phi(k-1) sigma, sigma squared) + .05N(.95phi(k-1) sigma, k squared, sigma squared). It is shown that for moderately sized sample, inferences regarding sigma sigma squared sub e = var(e sub ij) are insensitive but those of sigma squared sub a = var(a sub i) are very sensitive to changes of the two non-normality parameters (k, phi). Author (TAB)

N69-31544# California Univ., Livermore. Lawrence Radiation Lab.
TURBULENCE AS A MOTION OF A WIENER SPACE
M. Neuman 4 Dec. 1968 29 p refs Sponsored by AEC
(UCRL-50557) Avail: CFSTI

A straightforward application of Wiener's technique to statistical hydrodynamics leads to what is essentially a functional Lagrange representation of the equations of motion. In this article a functional Euler representation is introduced which seems more appropriate to the problem of turbulence. The equations of motion are transcribed in the new representation. Also the hypothesis is put forward that turbulence is, in a sense, a quasi-ergodic motion in the Wiener measure space, and some analytic consequences are deduced from this hypothesis. These are represented as differential constraints on the expansion coefficients of the velocity in terms of Wiener-Hermite functionals. Author (NSA)

N69-31562*# Brown Univ., Providence, R. I. Center for Dynamical Systems.
ADMISSIBILITY AND NONLINEAR VOLTERRA INTEGRAL EQUATIONS
R. K. Miller [1969] 15 p refs
(Grant NGL-40-002-015; Contract DA-31-124-ARO(D)-270)
(NASA-CR-103290) Avail: CFSTI CSCL 12A

The behavior of solutions of a nonlinear system x(t) = f(t) + $\int_0^t$ a(t,s)(x(s) + g(s,x(s)))ds is studied given certain information concerning the corresponding linear system y(t) = f(t) + $\int_0^t$ a(t,s)y(s)ds. These equations are studied in the abstract form. The corresponding definitions, corrolaries, lemmas, theorems, and proofs are stated and discussed in this paper. Author

N69-31627# Technische Hogeschool, Eindhoven (Netherlands).
THE STATISTICAL ESTIMATION OF PROVABILITY IN THE FIRST ORDER PREDICATE CALCULUS
S. Christiaan Van Westrhenen (Ph.D. Thesis) 1969 115 p refs
Avail: CFSTI

A theory of statistical decision functions used as an heuristic aid in theorem proving in propositional calculus and first order predicate calculus is presented. A Bayes decision function is proved to exist by which a formula can be estimated provable. An extension of methods to the theory of definition and to polyadic logics is given. A statistical analysis of the experimental results of theorem proving using an electronic computer is included, as well as a computer program for the semantic tableaux method in propositional calculus. A computer program, called a random generator, which selects an element from a finite set of well-formed propositional formulas, is also discussed. J.A.M.

N69-31639# Wisconsin Univ., Madison. Mathematics Research Center.
LINKAGES AND DISTANCE GEOMETRY Technical Summary Report
I. J. Shoenberg Jul. 1968 34 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-686130; MRC-TSR-906) Avail: CFSTI CSCL 12/1

A linkage is a connected collection of rigid but articulated rods. If the number of missing connections between vertices is k then the shape of the linkage can be represented by a point in the phase space R superscript k. For each integer r, 1 = or < r = or < n (where n + 1 is the number of vertices of the linkage) the paper presents a method of determining the set of those points of R superscript k, furnishing a shape of the linkage that lies in the space E sub r, but not in E sub (r-1). Author (TAB)

N69-31642# Wisconsin Univ., Madison. Mathematics Research Center.
ON SOME CONJECTURES OF P. WYNN CONCERNING THE EPSILON-ALGORITHM Technical Summary Report
T. N. E. Greville May 1968 33 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-686123; MRC-TSR-877) Avail: CFSTI CSCL 12/1

By numerical counter-examples, two conjectures of P. Wynn concerning the application of the epsilon-algorithm to vectors and rectangular matrices are shown to be false. The matrix conjecture is found to be true, however, for a restricted class of matrices. Author (TAB)

N69-31649# Wisconsin Univ., Madison. Mathematics Research Center.
A GENERALIZATION OF DIMENSIONAL ANALYSIS
M. J. Moran and R. A. Gaggioli Sep. 1968 39 p refs Prepared in Cooperation with Ohio State Univ.
(Contract DA-31-124-ARO(D)-462)
(AD-686136; MRC-TSR-927) Avail: CFSTI CSCL 12/1

Recent group theory techniques for the purpose of reducing the number of independent variables in systems of partial differential

equations subject to boundary and/or initial conditions are applied to dimensional analysis. Specifically, it is shown that a generalization of conventional dimensional methods can be effected via the techniques. Author (TAB)

N69-31654# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
PARTIAL SYMMETRY, EQUIVALENCE THEOREMS, AND CALCULATION OF HIGHER ORDERS IN NONRENORMALIZABLE FIELD THEORIES
A. T. Filippov 1968 19 p refs
(JINR-E2-4189) Avail: AEC Depository Libraries

Methods of calculations of higher-order corrections in non-renormalizable field theories are critically investigated. The inconsistency of perturbation theory (with a cut-off on the unitary limit) is strongly suggested and alternative methods are discussed. The nonrenormalizable theories with partial symmetries prove to be of particular interest. For these theories a new method based on the extensive use of the approximate Ward-type identities is developed. Author (NSA)

N69-31661*# Brown Univ., Providence, R. I. Center for Dynamical Systems.
AN INVARIANCE PRINCIPLE FOR DYNAMICAL SYSTEMS ON BANACH SPACE: APPLICATION TO THE GENERAL PROBLEM OF THERMOELASTIC STABILITY
M. Slemrod and E. F. Infante 17 Jun. 1969 9 p refs
(Grant NGL-40-002-015; Contract DA-31-124-ARO(D)-270)
(NASA-CR-103268; TR-69-3) Avail: CFSTI CSCL 12A

Mathematical analysis with a generalized form of the invariance principle used for ordinary differential equations was applied to the general problem of thermoelastic stability. The notation and concepts of the invariance principle are defined on a Banach space. Definitions of a generalized solution of the problem in an abstract dynamical system are given. A stability analysis is demonstrated to the point of asymptotic solution. M.H.E.

N69-31662# California Univ., Berkeley. Operations Research Center.
TWO SENSITIVITY ANALYSIS PROBLEMS IN NETWORKS
Joseph Degrand Dec. 1968 50 p refs
(Contract DA-31-124-ARO(D)-331)
(AD-685829; ORC-68-28; AROD-5307.37-M) Avail: CFSTI CSCL 12/2

The paper is concerned with two sensitivity analysis problems on a network each arc of which is subject to one or to more than one reduction in its length. Suppose that a total number of s reductions can occur on the whole network. The two problems are the following: (i) Which arc should be reduced such that the shortest route from source to any node i is reduced the most. (ii) Which arcs should be reduced such that the sum of all the shortest routes between each pair of nodes is reduced the most. In (i) we generalize Dantzigs algorithm concerning the shortest route from source to sink in a graph. In (ii) we generalize Dantzigs algorithm concerning the shortest routes between each pair of nodes in a directed graph. Author (TAB)

N69-31667# Wisconsin Univ., Madison. Mathematics Research Center.
PERRON-FROBENIUS PROPERTIES OF Ax (LAMBDA) Bx
O. L. Mangasarian Nov. 1968 33 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-686138; MRC-TSR-952) Avail: CFSTI CSCL 12/1

The purpose of the work is to extend some of the results of Perron and Frobenius to the following generalized eigenvalue problems: Ax = (lambda)Bx and Ay = (lambda)By where A and B are m x n real matrices and the prime denotes the transpose. Author (TAB)

N69-31671# Wisconsin Univ., Madison. Mathematics Research Center.
NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS BY GROEBNER'S METHOD OF LIE-SERIES Technical Summary Report
H. Knapp and G. Wanner Jun. 1968 76 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-686125; MRC-TSR-880) Avail: CFSTI CSCL 12/1

Groebners method of Lie-series, which is a numerical method of high order accuracy for ordinary differential equations, is described. TAB

N69-31685# Wisconsin Univ., Madison. Mathematics Research Center.
INTEGRAL REPRESENTATIONS FORJACOBI POLYNOMIALS AND SOME APPLICATIONS Technical Summary Report
Richard Askey and James Fitch May 1968 39 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-686127; MRC-TSR-889) Avail: CFSTI CSCL 12/1

A systematic treatment of integrals connecting Jacobi polynomials is given and one new one is obtained. Applications are given of these integrals to certain sums of Jacobi and ultraspherical polynomials. TAB

N69-31691*# Santa Clara Univ., Calif. Dept. of Electrical Engineering.
ALGEBRAIC METHODS FOR CONTROL SYSTEM ANALYSIS AND DESIGN Final Report, Apr. 1967--Apr. 1969
Dragoslav D. Siljak and G. J. Thaler May 1969 147 p refs
(Grant NGR-05-017-010)
(NASA-CR-103297) Avail: CFSTI CSCL 12A

The research on algebraic methods for analysis and design of control systems for the past two years are presented. They are divided into three major areas: (1) linear system design, (2) absolute stability analysis of nonlinear systems, and (3) approximate nonlinear analysis. The results are outlined for each area separately. Since most of the research was published, only a brief summary for each topic is given, and the list of the references is included. For convenience, pertinent papers are also included. Author

N69-31693# California Univ., Los Angeles. Dept. of Mathematics.
INTEGRAL REPRESENTATIONS OF HARMONIC FUNCTIONS ON RIEMANNIAN SPACES
Young Koan Kwon (Ph.D. Thesis) Mar. 1969 107 p refs
(Grant DA-AROD-31-124-G855)
(AD-685811; TR-46; AROD-6929.19-M) Avail: CFSTI CSCL 12/1

Maximum principles are established for HB- and HD- functions on a subregion of a Riemannian N-space R. Consequently the harmonic decomposition theorem is valid for R. TAB

N69-31706# United Kingdom Atomic Energy Authority, Harwell (England).
EVALUATION OF LEAST SQUARES METHODS OF ANALYSING DECAY DATA
D. C. Robinson Nov. 1968 25 p refs
(AERE-R-5911) Avail: CFSTI; UK 4s

The common method of analyzing decay curves by fitting a straight line to the logarithm of the decay curve using the reciprocals of the numbers of counts per channel as weights was found to introduce an error of the order of 0.5% in the lifetime. The

dependence of this error on the number of counts accumulated, the number of half-lives analyzed, and the background can be described by an empirical formula. It is shown that a much better method is to use an iterative procedure to fit an exponential to the counts observed, using the numbers produced by the fit as weights instead of the actual counts. Author (NSA)

N69-31722# Wisconsin Univ., Madison. Dept. of Statistics.
TOLERANCE REGIONS: A SURVEY OF ITS LITERATURE. PART 6: THE BAYESIAN APPROACH
Irwin Guttman Aug. 1968 38 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-686294; TR-127-PT-6) Avail: CFSTI CSCL 12/1

The document reviews the literature that is devoted to the problem of constructing tolerance regions using the classical sampling theory framework. Author (TAB)

N69-31746# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
MATHEMATICAL TREATMENT OF METABOLIC DATA BY THE THEORY OF COMPARTMENTS [TRAITEMENT MATHEMATIQUE DE DONNEES METABOLIQUES LIEES A LA THEORIE DES COMPARTIMENTS]
J. P. Bazin, B. Marchadier, and J. Lafuma [1968] 14 p refs In FRENCH 1st Congr. on Radiation Protec. and Exhibition on Equipment using Low Energy and Short Range Radiation Dosimetry, Menton, France, 9 Oct. 1968
(CEA-CONF-1175; CONF-681013-8) Avail: AEC Depository Libraries

A Monte Carlo method for the mathematical treatment of metabolic data connected with the theory of compartments is derived. For a reasonable precision the cost of the Monte Carlo method is much below systematic sweep methods and it is about equal to that of the iterative methods presently used. NSA

N69-31747# Union Carbide Corp., Oak Ridge, Tenn. Computing Technology Center.
FACTORABLE DETERMINANTS
K. O. Bowman and L. R. Shenton 6 Mar. 1969 15 p ref
(Contract W-7405-ENG-26)
(CTC-10) Avail: CFSTI

A solution for a bordered continuant matrix which arises in the solution of a linear system of differential equations associated with a statistical estimation problem is given. The matrix is evaluated by successive application of premultiplication and postmultiplication techniques which allow the determinants to be factored into a power of n. The resultant determinants are included. NSA

N69-31762# California Univ., Berkeley. Operations Research Center.
THE AUTOMATIC CALCULATION OF THE RELIABILITY OF COHERENT STRUCTURES
Robert Larribeau, Jr. Mar. 1969 49 p refs
(Contract Nonr-3656(18); Grant NSG GK-1684)
(AD-686156; ORC-69-4) Avail: CFSTI CSCL 14/4

A computer program is described that permits the calculation of the exact reliability of complex systems. The concept of a Coherent Structure is used to represent the system as a two terminal network. This thesis describes the data structures and algorithms needed to take the two terminal network, produce the proper arithmetic expression, and do an evaluation to find an exact reliability. Author (TAB)

N69-31764# Wisconsin Univ., Madison. Mathematics Research Center.
ON A CHARACTERIZATION OF THE BOHR GROUP Technical Summary Report
V. Mandrekar and D. J. Patil Sep. 1968 16 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-686131; MRC-TSR-908) Avail: CFSTI CSCL 12/1

The paper contains two main theorems. Theorem I characterizes the Bohr group topologically, and Theorem II gives a group structure on the maximal ideal space B of the almost periodic functions. The space B along with its topology becomes a topological group. A conjecture due to Hewitt is settled as a consequence of Theorem I. Author (TAB)

N69-31765# Wisconsin Univ., Madison. Mathematics Research Center.
LAGRANGE AND HERMITE INTERPOLATION IN BANACH SPACES Technical Summary Report
P. M. Prenter Oct. 1968 28 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-686134; MRC-TSR-921) Avail: CFSTI CSCL 12/1

Lagrange and Hermite interpolating polynomials are derived for functions f mapping a Banach space X into itself, where polynomials P sub x = the sum from 0 to N of (L sub n)(x to the n power) are sums of k-linear operators L sub K. TAB

N69-31766# Wisconsin Univ., Madison. Mathematics Research Center.
ON THE REDUCTION OF DIFFERENTIAL EQUATIONS TO ALGEBRAIC EQUATIONS Technical Summary Report
M. J. Moran and R. A. Gaggioli Aug. 1968 11 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-686135; MRC-TSR-925) Avail: CFSTI CSCL 12/1

Techniques based upon elementary group theory for the reduction of a given system of partial differential equations to a system of differential equations in fewer independent variables are extended in this report. Specifically, the extension is aimed at reducing a given system to a system of algebraic equations. Author (TAB)

N69-31775# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
THE INFINITESIMAL OPERATORS OF THE REGULAR REPRESENTATION OF THE NONCOMPACT GROUPS OF ROTATION O(pq) [INFINITEZIMAL'NYE OPERATORY REGULYARNOGO PREDSTAVLENIYA NEKOMPAKTNYKH GRUPP VRASHCHENII O(P,Q)]
A. N. Leznov 1968 14 p refs In RUSSIAN
(IFVE-STF-68-51-K) Avail: AEC Depository Libraries

A method for constructing infinitesimal operators of the regular representations of the noncompact group of rotation O(pq) is developed. A prescription for constructing the irreducible representations of the noncompact groups by using a transition to the limit representation, which is received from the regular one at infinite values of noncompact parameters is described. Author (NSA)

N69-31781# Joint Publications Research Service, Washington, D.C.
FIRST ALL-UNION CONFERENCE ON GAME THEORY
V. Petsyukov 9 Jul. 1969 7 p Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Tekhnicheskaya Kibernetika (Moscow), no. 1, 1969 p 173-176
(JPRS-48377) Avail: CFSTI

Described are the principle objects of game theory research, the categories of research, and the connections which the theory of games has with other sciences. The main emphasis is placed on the following aspects: (1) game theory as a branch of mathematics with the game as a basic object of the study; (2) results and prospects of the game theory; and (3) game theory and its interrelationships with probability theory, the study of operations, information theory, and cybernetics. G.G.

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N69-30579*# Nevada Univ., Reno. Mackay School of Mines.
GROUND TRUTH FLIGHT DATA MISSIONS 55 AND 56. SITE 55, MT. LASSEN; SITE 19, SONORA PASS; SITE 3, MONO CRATERS
Jack G. Quade, Peter E. Chapman, Peter A. Brennan, and Pat Robertson Oct. 1967 44 p *Its* Tech. Letter No. 10 (Contract NAS9-7044)
(NASA-CR-101760) Avail: CFSTI CSCL 04B

The overflight at Mt. Lassen test site was flown twice (once during the night and once during the day). The variation in some of the daytime temperature measurements from station to station was a direct result of cloud cover which developed during the daytime overflight and partially covered the entire flight line. The night mission was completely free of cloud cover. The ground data were collected primarily to support the microwave and the infrared airborne sensors. Three overflights were monitored from the ground in direct support of the infrared spectrometer experiment. All three flights were flown in the daytime beginning at Sonora Pass twice and Mono Lake once. Radiosondes were used to measure moisture content and temperature. Author

N69-30619# Freie Univ., Berlin (West Germany). Institut fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 90, NO. 8: RESULTS OF THE ASCENTS OF THE RADIOSONDE STATION, BERLIN-TEMPELHOF, OF THE INSTITUT FUER METEOROLOGIE UND GEOPHYSIK OF THE FREIE UNIVERSITAET BERLIN, AUGUST 1968. DAILY MEASUREMENTS AND CLIMATOLOGICAL VALUES AS WELL AS MEASUREMENT DATA FROM SPECIAL ASCENTS [METEOROLOGISCHE ABHANDLUNGEN. BAND XC, HEFT 8: ERGEBNISSE DER AUFSTIEGE DER RADIOSONDENSTATION, BERLIN-TEMPELHOF, DES INSTITUTS FUER METEOROLOGIE UND GEOPHYSIK DER FREIN UNIVERSITAET BERLIN IM JAHRE 1968, AUGUST. TAEGLISCHE MESSRESULTATE UND KLIMATOLOGISCHE WERTE, SOWIE MESSERGEBNISSE VON SPEZIALAUFSTIEGEN]
Richard Scherhag et al 1969 113 p refs In GERMAN; ENGLISH summary
Avail: CFSTI

The detailed results of the radiosonde ascents are presented. Using these data monthly time cross sections of the averaged temperature and the zonal and meridional wind components in heights above 30 km were constructed. Extreme and mean values of the temperature, pressure, geopotential, wind data, refractivity, pseudopotential temperature, and velocity of sound were extracted for all standard pressure surfaces, several height levels, the tropopause, and the freezing level. The data of the ozone-ascents were given in tabular and graphical form. Author

N69-30724 Freie Univ., Berlin (West Germany). Institut fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 101, NO. 1: RESULTS OF THE SYNOPTIC SERVICE DURING 1969. DAILY WEATHER MAPS (GROUND, 500 mb, 300 mb) AND BRIEF SCIENTIFIC ARTICLES [METEOROLOGISCHE ABHANDLUNGEN. BAND CI, HEFT 1: ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1969, JANUAR. TAEGLICHE WETTERKARTEN (BODEN, 500 mb, 300 mb) UND KLEINERE WISSENSCHAFTLICHE AUFSAETZE]
Richard Scherhag et al 1969 180 p refs In GERMAN
Avail: Issuing Activity

The daily weather maps for this period cover the Northern Hemisphere as a whole as well as the North Atlantic region and Central Europe separately. In addition, the following are presented for the same period: (1) summaries of climatological averages, atomospheric temperatures, precipitation, and radioactivity in Berlin, Germany; (2) winter sport situation reports for Germany during the reporting period; and (3) brief articles on the world weather situation, a new world record in atmospheric pressure recorded over Western Siberia, a weather forecast for Central Europe, numerical forecasting techniques, and a city snow fall due to an unusual temperature inversion. Transl. by K.W.

N69-30898# Illinois State Water Survey, Urbana.
RAINDROP DISTRIBUTIONS NEAR FLAGSTAFF, ARIZONA Final Report, 12 May 1967–11 May 1968
Douglas M. A. Jones Jan. 1969 57 p refs
(Grant DA-ARO(D)-31-124-G937)
(AD-685031; AROD-7362-2-EN) Avail: CFSTI CSCL 4/2

The Illinois State Water Survey raindrop camera was operated from 9 July through 19 August 1967 at the Fort Valley Experimental Forest near Flagstaff, Arizona, before, during, and after a period of cloud seeding. Drop-size distributions were determined for showers which were seeded and unseeded and showers with and without the occurrence of hail. It was found, on the average, that seeded showers and natural showers forming in more humid air masses have fewer large drops and more drops per cubic meter for the same rainfall rate than have showers accompanied by hail and unseeded showers forming in relatively dry air masses. The increase in the relative number of drops at rainfall rates greater than 30 mm hr was investigated and found to be the result of the breakup of drops larger than 2.0 mm diameter. It is concluded that the peculiarity of the Flagstaff distributions lies in the extraordinary number of very large drops which fall in showers forming in relatively dry air and that these large drops do not break up easily because they are the remnants of hailstones. Author (TAB)

N69-30978# RAND Corp., Santa Monica, Calif.
LAG CORRELATIONS BETWEEN ARCTIC ATMOSPHERIC HEAT LOSS AND NORTHERN HEMISPHERE CIRCULATION INDICES
R. E. Huschke and C. B. Leovy Sep. 1968 20 p refs
(AD-675982; P-3928) Avail: CFSTI CSCL 4/2

A time series of 'atmospheric heat loss' parameters for the arctic is calculated using 5 years of radiosonde and cloud data. Thirty-day deviations from the mean annual cycle of atmospheric heat loss are lag-correlated with corresponding anomalies of several indices of northern hemisphere circulation. Resulting correlation coefficients are small but statistically significant, interesting, and as yet, unexplained. Author (TAB)

N69-31039# Washington Univ., Seattle. Dept. of Electrical Engineering.
FLUCTUATIONS OF A FOCUSED BEAM WAVE FOR ATMOSPHERIC TURBULENCE PROBING

Akira Ishimaru Jan. 1969 40 p refs
(Contract F19628-69-C-0123)
(AD-686165; TR-128; SR-1; AFCRL-69-0040) Avail: CFSTI CSCL 4/1

The paper demonstrates that a focused beam wave may be effectively used to probe the atmospheric turbulence. Unlike plane and spherical waves, the focused beam has two parameters, i.e. the beam size and the radius of curvature of phase front at the aperture which may be easily varied experimentally. General formulations for the amplitude and phase correlation functions and structure functions of a focused beam wave are given including the effects of wind velocity and time delay. The effects of the beam size and the focal length on the spectral and spatial filter functions and temporal frequency spectrum are examined in detail including the effects of separation, wind velocity and time delay. Using these functions, procedures are shown to probe the form of the spectral density of the index of refraction, the structure constant and the wind velocity along the path. Author (TAB)

N69-31044# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
STUDIES OF ATMOSPHERIC PREDICTABILITY Final Scientific Report, Mar. 1966–Jan. 1969
Edward N. Lorenz Feb. 1969 151 p refs
(Contract AF 19(628)-0119)
(AD-686170; AFCRL-69-0119) Avail: CFSTI CSCL 4/2

The range at which good forecasts of the weather are possible is limited by the rate at which separate solutions of the governing dynamic equations diverge from one another. Studies aimed at determining this rate have thus far employed a dynamical approach, an empirical approach, or a dynamical-empirical approach. A comparison of these three approach points to a value of about three days as the best estimate of the average doubling time for small differences between solutions. Author (TAB)

N69-31054# California Univ., Los Angeles. Dept. of Meteorology.
DESCRIPTION OF THE MINTZ-ARAKAWA NUMERICAL GENERAL CIRCULATION MODEL
W. E. Langlois and H. C. W. Kwok 1 Feb. 1969 99 p refs
(Grants NSF GP-4190; NSF GA-778; NSF GA-1470)
(TR-3) Avail: Issuing Activity

The large-scale motion of the earth's atmosphere has emerged in recent years as a physical problem in which the digital computer is a primary research tool. The general circulation model developed is relatively easy to work with, largely because it makes no attempt to couple the Schwarzschild–Milne integro-differential equation of radiative transfer to the thermohydrodynamical system. Rather, the radiative inputs are parameterized in a way determined partially by theoretical consideration and partially by meteorological experience. This greatly simplifies the governing equation system. Moreover, it removes the need for the fine vertical resolution needed to integrate the Schwarzschild-Milne equation; the vertical structure is determined instead by much less demanding. The model described in this report resolves the troposphere into two vertical levels. Author

N69-31095# RAND Corp., Santa Monica, Calif.
CHANGING CLIMATE
J. O. Fletcher Sep. 68 28 p refs
(AD-675950; P-3933) Avail: CFSTI CSCL 4/2

The following questions are discussed: (1) Is global climate changing? (2) What is the pattern of global climatic change? (3) What causes global climate to change? (4) Is man's activity inadvertently influencing global climate? (5) What are the possibilities for purposefully influencing global climate? (6) What interest and competence have been shown by nations of the world in global climate control? (7) What can be done to speed progress? Author (TAB)

N69-31099# Environmental Science Services Administration, Silver Spring, Md.
COASTAL WEATHER AND MARINE DATA SUMMARY FOR GULF OF ALASKA, CAPE SPENCER WESTWARD TO KODIAK ISLAND
Harold W. Searby May 1969 37 p refs
(EDSTM-8) Avail: CFSTI

Economic activity and development in coastal regions and adjacent continental-shelf areas is increasing the need for and use of environmental data applicable to a broadening spectrum of engineering, shipping, and industrial operations. Data summaries of weather, climatic, and marine conditions, and environmental hazards, that can affect operations in, and the development of, coastal regions were compiled. This publication is a coastal weather and marine data summary for the Gulf of Alaska from Cape Spencer westward to Kodiak Island. Author

N69-31110# Environmental Data Service, Silver Spring, Md.
AN ANNOTATED BIBLIOGRAPHY ON THE CLIMATE OF CZECHOSLOVAKIA
H. K. Gold and Henry Hacia Jul. 1968 52 p refs
(AD-673494; WB/BC-99) Avail: CFSTI CSCL 4/2

The bibliography is one of a continuing series prepared at irregular intervals by the Foreign Branch, Climatology Division, Environmental Data Service. The Bibliography on the Climate of Czechoslovakia has been compiled from sources found in either the Atmospheric Sciences Library (DAS) or the Library of Congress (DLC). Author (TAB)

N69-31134# Weather Bureau, Salt Lake City, Utah. Western Region.
TEMPERATURE TRENDS IN SACRAMENTO, ANOTHER HEAT ISLAND
Anthony D. Lentini Feb. 1969 29 p refs
(PB-183055; WBTM-WR-36) Avail: CFSTI CSCL 4B

The study of the temperature regime at Sacramento, which has a long period of record (90 years), provides additional evidence supporting the heat island concept. This is especially true when compared to similar data from the University of California at Davis with its rural exposure. The university is only 15 miles from Sacramento over flat terrain; therefore, both should experience the same climatic changes. However, whereas Sacramento's average maximum temperature trend during summer (June-September) and winter (December-March) months is upward due to the heat island effect, the Davis trend is downward. The trend of the Davis minimum temperature of the same periods is upward, opposite that of its maximum temperature trend. This demonstrates a tendency for a nighttime heat island effect. Author (USGRDR)

N69-31135# Weather Bureau, Silver Spring, Md. Equipment Development Lab.
REMOTE READOUT PANEL FOR A DIGITAL PRECIPITATION GAGE
Francis V. Kohl Mar. 1969 19 p refs
(PB-183056; WBTM-EDL-9) Avail: CFSTI CSCL 04B

The paper describes the design, development, and operation of a remote indicator for use with digital recording precipitation gages used by the Weather Bureau. The unit presents the gage reading on a set of coded display lamps. A summary of test and evaluations made on the unit is included. Author (USGRDR)

N69-31137# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
WEATHER DISTURBANCES OVER TROPICAL CONTINENTS AND THEIR EFFECT ON GROUND CONDITIONS

Allan F. Rainbird (M.S. Thesis) Sep. 1968 60 p refs
(Contract DA-28-043-AMC-01303(E))
(AD-686321; Rept-1) Avail: CFSTI CSCL 4/2

The relative contributions to tributary and main stream flood flows of the three types of synoptic disturbance associated with heavy summer monsoon rainfalls over the lower Mekong River basin were examined for the 1961-63 period. Lower tropospheric cyclones were found to be more productive for flood runoff than mid-tropospheric disturbances (cyclones and equatorial trough shearlines). Antecedent conditions exercised a major influence on the magnitudes of peak flood discharges resulting from individual periods of enhanced broad-scale rainfall. The higher flood flows resulted most frequently from a lower tropospheric cyclone following closely upon stream rises due to mid-tropospheric disturbances. Heavy concurrent runoff to adjoining reaches of the Mekong River was found more likely to result from lower than mid-tropospheric systems. Author (TAB)

N69-31139# San Fernando Valley State Coll., Northridge, Calif.
CLIMATIC NORMALS AS PREDICTORS. PART 2: EXTENSION
Arnold Court 1 Nov. 1968 80 p
(Contract-AF 19(628)-5176)
(AD-686163; SR-2; Rept-82-68-2; AFCRL-68-0673) Avail: CFSTI CSCL 4/2

Temperature and precipitation for a single month or year, picked at random, at each of seven United States stations are found to be estimated as closely, on the average, by the mean of the preceding 10 to 40 years as by a 30-year normal. The median value for the preceding 15 or so years may be an even slightly better estimator. Graphs show the mean square and mean absolute differences between k-year means and the next observation for k = 1 (1) 50, and the mean absolute differences between k-year medians and the next observation for k = 1 (2) 49, for Dodge City, Vicksburg, Memphis, Cairo, Madison, Pittsburgh, and Lynchburg. Comparison of these graphs with corresponding graphs based on random normal numbers, biased in various ways, suggests that many climatic records contain progressive changes in mean or in variance, or both. The number of antecedent years (k^*) for which the mean or median is closest to the next years observation varies erratically from month to month, but tends to be the same at nearby stations for a given month. Author (TAB)

N69-31158# Weather Bureau, Silver Spring, Md. Techniques Development Lab.
A COMPARISON OF TWO METHODS OF REDUCING TRUNCATION ERROR
Robert J. Bermowitz May 1969 10 p refs
(WBTM-TDL-20) Avail: CFSTI

The comparative reduction of truncation error by shrinking the space scale and using a higher order approximation of the derivative is examined. It is found that for wavelengths less than about 2000 km, use of the second order approximation with a grid interval of 190.5 km results in a greater reduction of truncation error than a fourth order approximation with a grid interval of 381 km. Two fourth order approximations are also compared and found to give similar results. Considering the effects of truncation error alone, it is inferred that the shortest wavelength whose movement can be predicted with about 90% accuracy, with use of a fourth order approximation, is approximately 4.5 times the grid interval being used in the computations. Author

N69-31196# Weather Bureau, Miami, Fla. National Hurricane Research Lab.
NUMERICAL EXPERIMENTS WITH A MULTILEVEL PRIMITIVE EQUATION MODEL DESIGNED TO SIMULATE THE DEVELOPMENT OF TROPICAL CYCLONES, EXPERIMENT 1
Stanley L. Rosenthal Jan. 1969 41 p refs
(PB-182985; ERLTM-NHRL-82) Avail: CFSTI CSCL 04B

The model assumes the storm to be circularly symmetric and is expressed in z-coordinates. The information levels correspond to pressures in the mean tropical atmosphere of 1015, 900, 700, 500, 300, 200, and 100 mb. The heating function for the cyclone-scale motion is simulated by a convective adjustment of the lapse rate towards a pseudoadiabat representative of ascent from the surface boundary layer. The rate of this adjustment is calibrated so that the vertically integrated heating function is related to the upward flux of water vapor through the surface boundary layer. These preliminary calculations clearly show the sensible heat exchange to be of crucial importance to the development process. Author (USGRDR)

N69-31484# Navy Underwater Sound Lab., New London, Conn.
SENECA LAKE METEOROLOGICAL AND SURFACE WATER DATA
Thomas R. Cummings Jan. 1969 17 p refs
(AD-686391; USL-980) Avail: CFSTI CSCL 4/2

The report presents meteorological and surface water data collected at Seneca Lake, N. Y. The meteorological data represent 33,899 data points collected from 1934 to 1958, and the surface water data represent 1,222 data points collected from 1967 to 1968. Author (TAB)

N69-31518# Weather Bureau, Silver Spring, Md. Data Acquisition Div.
THE COMPATIBILITY OF RADIOSONDE DATA AT STRATOSPHERIC LEVELS OVER THE NORTHERN HEMISPHERE
Raymond M. McInturff and Frederick G. Finger Dec. 1968 65 p refs
(AD-686296; ESSA-TM-WBTM-DATAC-2) Avail: CFSTI CSCL 4/2

Day-night differences in temperature and height are used as the basis for a system designed to achieve compatibility between data measured by the various radiosonde instruments employed throughout the Northern Hemisphere. The resultant compatibility adjustments in reported data are a prerequisite to the analysis of stratospheric constant-pressure charts above the 100-mb level. Details of the adjustment system are given. Author (TAB)

N69-31527# Army Materiel Command, Hanover, N.H. Cold Regions Research and Engineering Lab.
A HIGH-RESPONSE TRIAXIAL STRAIN-GAGE ANEMOMETER
Fust Odar Jan. 1969 22 p refs
(AD-685847; CRREL-RR-254) Avail: CFSTI CSCL 4/2

A triaxial semiconductor strain-gage anemometer measuring wind velocities in three directions and thereby also determining the direction of the wind was designed and subjected to many crucial tests under various conditions. It was found that the measurements were affected by temperature and vibrations. Temperature compensation in two directions was made and wind tunnel tests on an almost vibration-free platform were performed. The results show that this type of instrument can be successfully used to measure large-scale turbulences. Throughout this report, emphasis is placed on the compensation necessary for temperature and vibration effects and the determination of input-output relationships. It is concluded that it is possible to design a practical triaxial strain-gage anemometer with high-frequency response and high sensitivity and to measure wind velocities accurately with this type of instrument when temperature and vibration compensations are properly made. Author (TAB)

N69-31530# Emmanuel Coll., Boston, Mass. Oriental Science Research Lab.

CHARACTERISTIC PARAMETERS AND DYNAMICAL EQUATIONS OF ATMOSPHERIC MOTIONS

Zeng Qing-Zun Bedford, Mass. AFCRL Nov. 1968 27 p refs Transl. into ENGLISH from Ch'i Hsiang Hsueh Pao (Peking), v. 33, no. 4, Nov., 1963 p 472–483

(Contract F19628-68-C-0251)

(AD-686184; EMM-68-175; AFCRL-68-0608; AFCRL-Trans-32) Avail: CFSTI CSCL 4/2

Dynamical equations of atmospheric motions are studied by similarity principle and dimensional analysis. The relationships between the various models of the atmosphere and the limits of their applicability are shown. By analyzing the adiabatic motion of the inviscid flow assuming quasi-static equilibrium and the pressure gradient force and the coriolis force to have the same order of magnitude, three characteristic scales defined by external factors can be determined: the characteristic time scale dependent on the coriolis parameter, the characteristic velocity scale dependent on the stratification and the average temperature of the atmosphere and the characteristic scale of horizontal distance. A generalized system of finite-difference equations suitable for analysis and comparison is presented. The various models correspond to the different values of the coefficients in the equations. The asymptotic nature of the convergence in the method of expansion of small parameters is discussed. Equations for mesoscale systems (L < L0) are especially studied. Author (TAB)

N69-31540# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DEVIATION OF THE MEASURED TEMPERATURE, HUMIDITY, AND WIND SPEED GRADIENTS AT 1 m FROM THOSE CALCULATED BY THE LOGARITHMIC LAW UNDER NONEQUILIBRIUM CONDITIONS

A. A. Levenko Jan. 1969 14 p refs Transl. into ENGLISH from Tr. Nauchn.-Issled. Inst. Gidrometeorol. (Kiev), no. 62, 1966 p 56–64

(AD-686310; FTD-HT-23-1170-68) Avail: CFSTI CSCL 4/2

Results are presented of a study leading to the development of a method of determining, in an unstable atmosphere, the deviations of measured temperature, humidity, and wind-speed gradients from the values of these atmospheric characteristics calculated by the logarithmic law. Author (TAB)

N69-31576 World Meteorological Organization, Geneva (Switzerland).

AERONAUTICAL METEOROLOGY

1969 499 p refs Proc. of the WMO Sci. and Tech. Conf. on Aeron. Meteorology, London, Mar. 1968

(WMO-227.TP.121; TN-95) Avail: Issuing Activity

Conference papers are presented on weather forecasting in airport vicinities, meteorological conditions in troposphere and lower stratosphere, and meteorological support requirements of supersonic transport operations. For individual titles, see N69-31577 through N69-31616.

N69-31577 World Meteorological Organization, Geneva (Switzerland). Commission for Aeronautical Meteorology.

THE DEVELOPMENT OF AERONAUTICAL METEOROLOGY

N. A. Lieurance *In its* Aeron. Meteorology 1969 p 1–8 (See N69-31576 17-20)

Avail: Issuing Activity

The evolution of aeronautical meteorology is summarized from the early twentieth century to the present, and it is emphasized that the needs of aviation for meteorological information have not basically changed over this period of years. The refinement of meteorological methods and improvement in weather services have also paralleled the development of air travel, with great technological advancement and improvement in international cooperation evident in the post-World War 2 era. The period 1956–1966 is reported to be the most dynamic decade in the history of aviation and aeronautical meteorology, with the latter technology responding to jet age demands with high speed, computer-aided radio communication systems and by the introduction of weather satellites. Finally, four major technical problems are identified which must be examined in the future: (1) aerodrome visibility; (2) severe turbulence, both cloud-associated and clear air; (3) improved upper-air forecasts; and (4) faster and more efficient means of measuring, distributing, and presenting weather data to the aviator. A.C.R.

N69-31578 World Meteorological Organization, Geneva (Switzerland).

VARIATIONS IN WIND, TEMPERATURE AND TURBULENCE IN THE LOWEST 1 km

A. S. Dubov *In its* Aeron. Meteorology 1969 p 11–28 refs In RUSSIAN (See N69-31576 17-20)

Avail: Issuing Activity

Wind profile characteristics of atmospheric boundary layers are discussed in terms of flight conditions for near-runway altitudes. Emphasis is placed on the effects of wind velocity variations at different altitudes. Also considered are boundary layer theoretical models, turbulence exchange, gusts, and large scale perturbations. Transl. by E.C.

N69-31579 World Meteorological Organization, Geneva (Switzerland).

WIND REGIME IN THE LOWEST ONE HUNDRED METERS AS RELATED TO AIRCRAFT TAKE-OFFS AND LANDINGS

J. Clodman, F. B. Muller, and E. G. Morrissey *In its* Aeron. Meteorology 1969 p 29–43 (See N69-31576 17-20)

Avail: Issuing Activity

As a result of increased requirements for design precision and the demand for maximum utilization of aircraft and auxiliary facilities, a discussion is presented on the risks of extreme values of shear and other related stress phenomena for wind profiles near ground level. In addition, the interaction between various possible profiles and the operation of aircraft and ancillary systems is also considered. Long range wind data obtained from three airport towers for different altitudes were used to analyze atmospheric conditions as related to: (1) long-record frequency distributions; (2) cumulative frequency distributions; and (3) mean and standard deviations. A short term simulation study was also conducted. Taking into account the preliminary nature of both the long-term and short-term analyses, it was tentatively concluded that aircraft takeoff and approach operations at many airports are likely to experience wind shear distributions of considerable magnitude upon occasion, and that shear values in excess of 10 knots per 100 feet would not be uncommon. A.C.R.

N69-31580 World Meteorological Organization, Geneva (Switzerland).

VERTICAL WIND SHEAR IN THE BOUNDARY LAYER AT MELBOURNE AIRPORT

K. T. Spillane and R. R. Brook *In its* Aeron. Meteorology 1969 p 44–60 refs (See N69-31576 17-20)

Avail: Issuing Activity

The distribution of various time-averaged wind speed differences between 50 and 150 ft are shown to be open to simple but reliable statistical description for near neutral stability. The standard deviation of wind speed difference is highly correlated to wind speed at 150 ft, but direct measurement of mean shear, even by insensitive instruments, is recommended to ensure a good estimate of probable maximum events. Typical wind spectra at a single level were assumed, so that the degree of intermittencies

coupling between the levels, as a function of frequency, could be deduced from measured differences. This measure of coupling appears useful in estimating the spectrum of wind speed differences and should apply generally to other airports under similar stability conditions. Author

N69-31581 World Meteorological Organization, Geneva (Switzerland).
REPORT OF AN INVESTIGATION INTO LOW-ALTITUDE WIND STRUCTURE FOR AUTOMATIC LANDING
I. A. Watson *In its* Aeron. Meteorology 1969 p 61–96 refs (See N69-31576 17-20)
Avail: Issuing Activity

Low altitude wind structure around airports was investigated with particular emphasis on its effect on flare performance of the VC-10 aircraft. Three aspects of the structure were considered in order to obtain a realistic representation: (1) wind shear (variation in mean wind speed with height); (2) mean wind speed near the ground; and (3) gustiness. Since the main consideration was VC-10 autoflare, most of the data were concerned with longitudinal and, to some extent, vertical wind structure; a separate discussion on cross winds, however, is also included. From the analyses, probabilities of mean surface wind speeds, average wind shear, and gustiness were established, as well as the variation of gustiness with height. The probabilities of any given mean wind profile were not firmly established and can therefore only be estimated. A.C.R.

N69-31582 World Meteorological Organization, Geneva (Switzerland).
TIME AND SPACE VARIATIONS OF VISIBILITY AND LOW CLOUD WITHIN THE APPROACH CONTROL AREA
R. F. Jones *In its* Aeron. Meteorology 1969 p 97–101 (See N69-31576 17-20)
Avail: Issuing Activity

In order to establish a scale of variations, observations of visibility, runway visual range, and height of cloud base are discussed, and their variations with space and time are reported. Preliminary conclusions reached from the studies were as follows: (1) Meteorological visibility in the range 270-1000 m can change by 30% or more within four minutes in many instances; (2) Runway visual range from 360-1100 m can change at a rate of 100 m/min. (3) Runway visual range and meteorological visibility can vary by several hundred meters in 1.5 km or less; (4) Cloud base can often change at a given point by 45 m in one minute and by 60 m in ten minutes; (5) Cloud base may differ by 45 m over distances of 1.6 km and 60 m over distances of 5 km. On the basis of these observations, it was recommended that a new approach to forecasts is required which will take into account the inherent variability in major meteorological parameters on a small time and distance scale. A.C.R.

N69-31583 World Meteorological Organization, Geneva (Switzerland).
AN OPERATIONAL METHOD FOR PREDICTING THE HEIGHT OF THE PLANETARY BOUNDARY LAYER IN A STABLE ATMOSPHERE
E. C. Jarvis *In its* Aeron. Meteorology 1969 p 102–112 refs (See N69-31576 17-20)
Avail: Issuing Activity

Using data for a three-month winter period at Suffield, Alberta, a regression equation was generated to relate the height of the planetary boundary layer, the wind speed at the top of the boundary layer, and the magnitude of the wind shear through the boundary layer. When tested on independent data, the equation yielded a linear correlation coefficient of 0.78 and a root-mean-square error of 347 ft. It was also found operationally useful in predicting the occurrence or absence of stratus and stratocumulus bases near the lifting condensation level. If frontal and large-scale subsidence inversions are accounted for independently, the equation will give temperature inversions of the nocturnal type and provide a coarse, but practically useful, forecast of the temperature profile through the lower atmosphere. Author

N69-31584 World Meteorological Organization, Geneva (Switzerland).
EXPERIMENTAL INVESTIGATIONS OF LOWER CLOUD BASE VARIABILITY WITH SPACE AND TIME
K. E. Abramovitch and M. V. Rubinshteyn *In its* Aeron. Meteorology 1969 p 113–123 refs In RUSSIAN (See N69-31576 17-20)
Avail: Issuing Activity

Lower cloud base variability effects on weather forecast preparation in support of aircraft landing operations are considered. Factors discussed are: localized lower cloud base variability, the variability of lower cloud base height dependence on average cloud height, dependence of cloud base variability on cloud formation and synoptic conditions, variability characteristics over short duration observations, spatial variability and lower cloud base height, and comparisons of lower cloud base variability measurements by sounding or ground-based instruments with measurements from onboard aircraft. It is concluded that analyses of lower cloud base variability with space and time yield adequate data for developing quality landing condition forecasts provided meteorological observations in the vicinity of the airport are carried on continuously and automatic data processing techniques are applied. Transl. by E.C.

N69-31585 World Meteorological Organization, Geneva (Switzerland).
A RESEARCH PROGRAMME TO DEVELOP OBJECTIVE, COMPUTERIZED AERODROME FORECASTING
J. Clodman *In its* Aeron. Meteorology 1969 p 124–131 (See N69-31576 17-20)
Avail: Issuing Activity

The development of an automated procedure which will utilize directly received meteorological data and long range forecast information to issue short range, continuously updated forecasts is described. The output is to be available to users, such as dispatchers, controllers, and pilots, without an appreciable time lag. Since the technology for computing and communicating the information is already in existence, the objective is to develop a meteorological forecast methodology which can be economically implemented by automated equipment. The basic principles involved in such a system, data used in the preliminary studies, the computer program, and examples of possible output are included. Problems involved in each of the above areas and further plans for system development are also treated. A.C.R.

N69-31587 World Meteorological Organization, Geneva (Switzerland).
SPECTRA OF TRANSMISSOMETER RECORDS AND THEIR IMPLICATION ON AIRCRAFT FLIGHT PLANNING
J. Clodman *In its* Aeron. Meteorology 1969 p 139–141 (See N69-31576 17-20)
Avail: Issuing Activity

Visibility uncertainties arising from the tendency of most forecasting methods to examine only large time-scale parameters are discussed as they affect aircraft safe landing operations, and the need for reliable data on smaller time scales is emphasized. Power spectral analyses for a given site were used to demonstrate the probability of correctly forecasting the visibility conditions for short time periods. The transmissometer data were obtained during a 10-day trial study at Toronto International Airport. The results

were only preliminary in nature, with a greater number of sites and situations being necessary to obtain exact statistics on spectral variations with changing conditions. It was therefore recommended that further studies be conducted, particularly those involving the spectra in snow since this situation is more apt to combine strong winds with low visibility. A.C.R.

N69-31588 World Meteorological Organization, Geneva (Switzerland).
TIME AND SPACE VARIATION IN METEOROLOGICAL ELEMENTS IN THE AERODROME AND ITS VICINITY
H. Ito *In its* Aeron. Meteorology 1969 p 142–157 (See N69-31576 17-20)
Avail: Issuing Activity

Studies of local meteorological conditions were conducted to ascertain to what extent the observations at one site in the area of an airport are representative of the entire surroundings. Surface wind, temperature, and runway visual range were observed simultaneously in several locations with appreciable variations evident from site-to-site. These results are depicted graphically, showing average hourly and daily variations in wind direction and speed, wind shear, temperature, frequency of transmissivity period, and size distribution of cloud patches. A.C.R.

N69-31589 World Meteorological Organization, Geneva (Switzerland).
WIND INFORMATION FOR LANDING AND TAKE-OFF AND SITING OF INSTRUMENTS
P. J. Rijkoort and J. Wieringa *In its* Aeron. Meteorology 1969 p 156–166 (See N69-31576 17-20)
Avail: Issuing Activity

The problems of identifying wind phenomena that occur in the lower 100 m of the atmosphere and determining which of these are relevant to aircraft motion are discussed, as well as the need for more precise definition of the nature of such circulation and methods of transmitting the information quickly to airport controllers and pilots. The central problem appears to be in extrapolating the available measurements to the location of the aircraft at a given moment and to the time at which it is there. Several recommendations are made for improving upon the reliability of such information: (1) combined analysis of the relevant aspects of wind phenomena that affect aircraft safety, instead of treating them in separate studies; (2) better definitions of relevant wind parameters and more precise measurement of their values; (3) investigation of other factors affecting these parameters, such as thermal stability, actual shears, and wind direction; and (4) standardized heights for measuring surface wind and standardized averaging periods for mean wind calculations. A.C.R.

N69-31590 World Meteorological Organization, Geneva (Switzerland).
MESOSCALE AND MICROSCALE ANALYSES AND FORECASTS FOR AIRPORTS AND THEIR VICINITIES
Karl R. Johannessen *In its* Aeron. Meteorology 1969 p 167–183 refs (See N69-31576 17-20)
Avail: Issuing Activity

Mesoscale and microscale features of the atmosphere, particularly those related to meteorological variables in visibility and cloud height, are discussed in relation to forecasting terminal conditions around airports, and the benefits which may be derived from new techniques and equipment are evaluated. Topics include use of weather satellite photography, analysis of radar echoes produced by mesoscale phenomena, and the development of an experimental mesonet near Atlantic City, N.J. to evaluate the usefulness of a small, dense network of stations surrounding an airport. The preliminary conclusions drawn from these analyses are: (1) Mesonet contributions are not as yet obvious from a cost-benefit ratio. (2) Existing networks combining synoptic surface and upper air observations are inadequate for mesoscale forecasting. (3) Radar and weather satellites are valuable tools for this purpose. (4) Further experiments with mesonet-type installations should be conducted with the objective of improving short period terminal forecasts. A.C.R.

N69-31591 World Meteorological Organization, Geneva (Switzerland).
WIND FORECASTING IN JET STREAME
N. V. Petrenko *In its* Aeron. Meteorology 1969 p 187–196 refs In RUSSIAN (See N69-31576 17-20)
Avail: Issuing Activity

Procedures for calculating the level and magnitude of maximum wind velocity in the vicinity of a jet stream are described. The resulting values may be used to construct forecast charts of vertical wind shear of interest to jet aircraft pilots. In most cases, the formulas discussed permit calculations of the level of maximum wind velocity and its magnitude up to 65 m/sec with a degree of accuracy near to that obtained with existing methods. Transl. by E.C.

N69-31592 World Meteorological Organization, Geneva (Switzerland).
NUMERICAL PREDICTION OF UPPER WINDS AND TEMPERATURES, AND PRESENTATION OF THE NUMERICAL FORECASTS FOR AERONAUTICAL PURPOSES
L. Bengtsson *In its* Aeron. Meteorology 1969 p 197–210 ref (See N69-31576 17-20)
Avail: Issuing Activity

A numerical weather prediction system based on integration of the thermo-hydrodynamic equations of the atmosphere is described, and its operational efficiency is evaluated. Verification of the numerical forecasts indicated that the wind-vector error decreased to about 51% of that obtained by previous subjective forecasts, and that the corresponding reduction of temperature errors was 28%. A more efficient method of flight forecasting is also described, by which forecasts for Europe are distributed in tabular form, with mean winds and temperatures along over 100 flight tracks being computed from the grid network. This tabular form replaces telefacsimile charts and implies a considerable savings in time and personnel. Moreover, the errors resulting from manual interpolation procedures are eliminated. Author

N69-31593 World Meteorological Organization, Geneva (Switzerland).
UTILIZATION OF CYCLOSTROPHIC WIND IN WEATHER ANALYSIS AND PROGNOSIS
H. Regula *In its* Aeron. Meteorology 1969 p 211–217 (See N69-31576 17-20)
Avail: Issuing Activity

As a result of discrepancies between forecasts and actual wind conditions discovered during flights from West Germany to North America, an analysis was made of the causes of such variations. It appears that most errors were made in a specific synoptic situation, where an originally zonal circulation changed rapidly into a meridional one, such as when larger masses of warm air move northward across the North Atlantic. Further analysis resulted in the conclusion that wind velocities in the vicinity of jet streams must be calculated from a cyclostrophic, as opposed to a geostrophic, formula. The reasons for this observation are presented, and the phenomena related to rapid changes in zonal circulation are treated on the basis of meteorological charts and photographs obtained during the movement of hurricane Faith over the North Atlantic in September 1966. A.C.R.

N69-31584 World Meteorological Organization, Geneva (Switzerland).
FORECASTING OF UPPER WINDS AND TEMPERATURES IN TROPICAL LATITUDES WITH SPECIAL REFERENCE TO JET STREAMS
P. Koteswaram *In its* Aeron. Meteorology 1969 p 218–228 refs (See N69-31576 17-20)
Avail: Issuing Activity

A brief review of some recently developed techniques for computer analysis and forecasting for the upper troposphere in the tropics is presented. Characteristics of the subtropical westerly jet stream in winter and the tropical easterly jet in summer over Asia and Africa are discussed, with reference to the average conditions during representative months. Using all data available up to 1966, mean horizontal, as well as vertical, cross sections across these jets for January and July were constructed. Author

N69-31595 World Meteorological Organization, Geneva (Switzerland).
SOME ASPECTS OF THE CO-ORDINATION OF FORECASTING IN MIDDLE AND LOW LATITUDES IN RELATION TO WORLD WEATHER WATCH
J. S. Sawyer *In its* Aeron. Meteorology 1969 p 229–235 refs (See N69-31576 17-20)
Avail: Issuing Activity

The problem of updating weather forecasting techniques to include coverage of tropical regions which will match the advances made in predictions for the middle latitudes is discussed. It is anticipated that the World Weather Watch will soon exploit these advances through a system of world and regional meteorological centers using computer techniques. Specific topics related to better understanding of atmospheric circulation in tropical regions are: (1) atmospheric linkages between equatorial and middle latitudes; (2) dynamic patterns of the equatorial atmosphere; and (3) improved methods of extending numerical forecasting to low latitudes. Brief treatment is also given to future techniques for flight forecasting in the equatorial regions. A.C.R.

N69-31596 World Meteorological Organization, Geneva (Switzerland).
DETECTION AND FORECASTING OF CLEAR-AIR TURBULENCE AND MOUNTAIN WAVES
Dever Colson *In its* Aeron. Meteorology 1969 p 236–255 refs (See N69-31576 17-20)
Avail: Issuing Activity

Turbulence data over Alaska, Greenland, the North Atlantic and Caribbean areas, Mexico, and Central America are analyzed, based on information collected by the International Civil Aviation Organization (ICAO) during 1964–65. A review of earlier analyses of ICAO data over the United States is also given. In addition, recent U.S. studies on mountain waves, along with other clear air turbulence phenomena, are summarized, and the status of clear air turbulence detectors is reported. Author

N69-31597 World Meteorological Organization, Geneva (Switzerland).
CLEAR AIR TURBULENCE
N. R. Pinus, I. G. Pchelko, N. G. Shur, A. A. Vasiliev, and N. K. Vinnichenko *In its* Aeron. Meteorology 1969 p 256–268 refs In RUSSIAN (See N69-31576 17-20)
Avail: Issuing Activity

Problems in forecasting clear air turbulence are considered in relation to: (1) atmospheric turbulence theory, (2) turbulence zones, (3) statistical characteristics of clear air turbulence, (4) energy spectrum of pulsations in vertical and horizontal wind velocity components, and (5) clear air turbulence forecasting techniques. It is concluded that the most effective forecasts of clear air turbulence are compiled using synoptic methods, including charts showing vertical wind shear, in combination with in-flight reports of turbulence activity. Transl. by E.C.

N69-31598 World Meteorological Organization, Geneva (Switzerland).
ATMOSPHERIC TURBULENCE, WITH PARTICULAR REFERENCE TO THE SST
J. Burnham *In its* Aeron. Meteorology 1969 p 269–271 (See N69-31576 17-20)
Avail: Issuing Activity

The nature of the atmosphere in which SST aircraft cruise is briefly discussed as to the types of turbulence which are likely to cause structural failure. It is reported that past studies into this problem have indicated that the great majority of takeoff and landing accidents involving transport category aircraft during the last 20 years were attributable to large and rapid fluctuations in wind associated with thunderstorms; also, the effects of clear air turbulence were relatively insignificant. In addition, emphasis is placed on the fact that SST aircraft are designed to be more structurally reliable under extreme conditions than most presently used vehicles and should therefore be capable of withstanding greater environmental stress. A.C.R.

N69-31599 World Meteorological Organization, Geneva (Switzerland).
MESOSCALE ATMOSPHERIC CIRCULATION IN THE LOWER AND MEDIUM LEVELS OF THE STRATOSPHERE [LA CIRCULATION ATMOSPHERIQUE A MOYENNE ECHELLE (MESOSCALE) DANS LA BASSE ET LA MOYENNE STRATOSPHERE]
G. D. Barbé *In its* Aeron. Meteorology 1969 p 272–284 ref In FRENCH (See N69-31576 17-20)
Avail: Issuing Activity

Theoretical and experimental contributions to aerial navigation and turbulence in clear air are presented. Direct measurements by the double sounder technique of atmospheric circulation of the mesoscale in the lower and middle stratosphere were made in vertical layers (10 to 1 km), on a horizontal plane (10 km to 100-400 km), and in temperature gradients every 30 minutes in the vicinity of Paris. The double sounder technique consists of simultaneous double balloon and radar signals transmitted to a ground digital computer. Radar signature profiles demonstrated the presence of regular, repetitive circulation phenomena. The validation and reliability of the double sounder technique were substantiated by the data, and the hypothesis of mesoscale stratification was supported. Transl. by M.H.E.

N69-31600 World Meteorological Organization, Geneva (Switzerland).
THE ROLE OF AERONAUTICAL METEOROLOGICAL OFFICES WITHIN THE FRAMEWORK OF AN AREA FORECAST SYSTEM
M. H. Freeman *In its* Aeron. Meteorology 1969 p 285–288 (See N69-31576 17-20)
Avail: Issuing Activity

Recent trends toward centralized forecasts using computer techniques are briefly discussed, as well as the growth of area forecast systems. Both methods reduce duplication of forecasters' efforts and increase overall efficiency. Such centralization, however, could result in lack of interest on the part of many meteorologists; it is therefore recommended that efforts be made to encourage such personnel to devote their time to improving techniques for tasks which cannot yet be centralized. The most important areas in this respect are local airport forecasting and accurate predictions for low flying aircraft. A.C.R.

N69-31601 World Meteorological Organization, Geneva (Switzerland).
THE PROVISION OF METEOROLOGICAL INFORMATION TO AIRLINE OPERATORS FOR COMPUTERIZED FLIGHT PLANNING
H. M. de Jong *In its* Aeron. Meteorology 1969 p 289–304 refs (See N69-31576 17-20)
Avail: Issuing Activity

The complex mathematical and logistical computation procedures required for a computerized flight planning system are analyzed, and the problem of providing the large amounts of operational data required for optimum performance is discussed. Mention is made of the basic incompatibility between the integrated system, in which much basic information is noncyclic, and meteorological data, which must be transmitted and updated at regular intervals. In addition, it is stated that the geographical size of the area being covered will have an effect on the needs of a particular airline for meteorological services. Finally, the dependence of the system on methods of disseminating the basic data is discussed, and one of the most advanced techniques involving direct computer-to-computer communication between a meteorological center and the flight operator is described. A.C.R.

N69-31602 World Meteorological Organization, Geneva (Switzerland).
AN EXPERIMENT IN COMPUTERIZED FLIGHT PLANNING
L. Bengtsson *In its* Aeron. Meteorology 1969 p 305–313 (See N69-31576 17-20)
Avail: Issuing Activity

Results of experiments in computerized flight planning, insofar as optimizing cruise portions of the flight are concerned, are reported for flights between Copenhagen and New York. Criteria for determining the optimum track were based on equivalent still air distance. By restricting the problem in this way, considerable simplification is achieved, and the only non-meteorological information to be known (except time and place for departure and destination) is the valid Mach number for the aircraft. The studies indicated that optimization in time (actual time in every point in the network during the flight) is equally as important as achieving cruise optimization at the actual flight level. Author

N69-31605 World Meteorological Organization, Geneva (Switzerland).
SYNOPTIC CLIMATOLOGY OF THE UPPER AIR FOR SST AIRCRAFT REQUIREMENTS
R. Scherhag *In its* Aeron. Meteorology 1969 p 333–363 (See N69-31576 17-20)
Avail: Issuing Activity

The average behavior of the stratosphere is analyzed to distinguish between characteristics during the months of September to May, when disturbances similar to that in the troposphere are evident, and during June to August, when the temperature field and stream pattern appear very stable. Mean conditions to the 100 mb and 50 mb surface and the climatology of the 30 mb surface are described, based on weather maps constructed during the period 1951–1966. Aspects of the sudden stratospheric warming, first detected in 1952, are also considered, such as the stratospheric Aleution high during winter months. The unusually high warming phenomena that occurred during the winter of 1967–68 is described and depicted on charts at various stages of its development; several temperature measurements obtained by British rocket firings and the Berlin radiosonde for the period are analyzed. A.C.R.

N69-31606 World Meteorological Organization, Geneva (Switzerland).
INTERCORRELATION OF TEMPERATURE AND WIND, LONDON-NEW YORK, AT 50 mb
A. F. Crossley *In its* Aeron. Meteorology 1969 p 364–365 (See N69-31576 17-04)
Avail: Issuing Activity

The statistical relationship between wind and temperature in the lower stratosphere was analyzed over the flight route from London to New York and its effect on the safe operation of SST aircraft evaluated. Correlation coefficients derived from analysis of seasonal variations proved consistently negative in autumn and winter, whereas the sign varied in spring and summer with position along the route. A.C.R.

N69-31607 World Meteorological Organization, Geneva (Switzerland).
METEOROLOGICAL REQUIREMENTS FOR FUTURE AIRLINE OPERATIONS
In its Aeron. Meteorology 1969 p 366–380 (See N69-31576 17-20)
Avail: Issuing Activity

Future problems facing increased supersonic air traffic are discussed, with emphasis on the crucial need for a rigid form of international air traffic control, a reliable, directly transmittable forecasting service to inflight aircraft, and accurate short-term and long-range preflight weather data. The types of aircraft likely to be in operation within several decades are summarized, and computerized meteorological services are considered in four categories: (1) improvements in the utility of forecasts; (2) inclusion of additional weather elements in high speed, digital format; (3) transmission of presently forecast factors in digital format; and (4) improved handling of digital forecasts by flight planning computer. Specific climatological requirements for takeoff and landing operations are identified, as related to visibility, range of forecast, wind conditions, and effects on sonic boom problems. Meteorological services to in-flight aircraft and the influence of weather conditions on SST operation are also treated. A.C.R.

N69-31608 World Meteorological Organization, Geneva (Switzerland).
PRESENT STATE OF KNOWLEDGE REGARDING REQUIREMENTS OF SST AIRCRAFT PRELIMINARY AND INFLIGHT PLANNING FOR SYNOPTIC METEOROLOGICAL INFORMATION AT AERODROMES AND ALONG ROUTES [LES INFORMATIONS METEOROLOGIQUES SYNOPTIQUES NECESSAIRES A L'EXPLOITATION DES AVIONS COMMERCIAUX SUPERSONIQUES]
P. Duverge *In its* Aeron. Meteorology 1969 p 381–394 refs In FRENCH (See N69-31576 17-20)
Avail: Issuing Activity

Meteorological standards of weather forecasting, the provision of temperature information, and mesoscale temperature variability below 60,000 feet are studied for their relation to the economics of supersonic transport operations. For each stage of flight, i.e. take-off, subsonic climb with acceleration to 16,000 m, supersonic cruising, descent, and landing, fuel consumption rates and the effect of temperature and wind variations on fuel consumption were calculated with cost predictions based on % increase. A review of meteorological equipment studies (radiosondes) is in accord with aeronautical data that temperature measurement methods relayed to the pilot must be made more precise for the total efficiency of supersonic transport operations. Transl. by M.H.E.

N69-31609 World Meteorological Organization, Geneva (Switzerland).
THE FLIGHT-DECK VIEW OF THE WEATHER AFFECTING THE SST
J. R. C. Young *In its* Aeron. Meteorology 1969 p 395–398 (See N69-31576 17-20)
Avail: Issuing Activity

The three basic needs of the supersonic transport pilot for meteorological data are identified, and a brief discussion is presented on research in progress, methodology being developed, and equipment for use in providing the necessary weather information. The major areas of interest in SST operation are: (1) temperature in the upper region of the supersonic cruising range, especially the maxima and minima likely to be encountered; (2) atmospheric turbulence outside cumulus clouds resulting from wind shear; and (3) forecasting of areas of marked orographic wave instability, so that adequate warning can be given and avoiding action taken. A.C.R.

N69-31610 World Meteorological Organization, Geneva (Switzerland).
METEOROLOGICAL REQUIREMENTS FOR REPORTS FROM SST AIRCRAFT
P. K. Rohan *In its* Aeron. Meteorology 1969 refs p 399–405 (See N69-31576 17-20)
Avail: Issuing Activity

The advantages of meteorological observations taken aboard aircraft and made available at ground stations are discussed, with emphasis on the importance of these reports from SST aircraft cruising at relatively unexplored altitudes. The basic problem in determining the reporting requirements for SST flights was that an attempt was being made, in effect, to describe meteorological conditions which affect a new form of air transport before the first version model was flown and before the firm design of the next two or three versions under current development were known. Some knowledge has been gained from upper air networks operating at SST cruise levels, but gaps in the available knowledge still exist. Despite these problems, the anticipated cruise altitudes of supersonic aircraft are identified, as well as the meteorological elements of direct interest to the SST flights. These are: temperature, wind, turbulence, cloud coverage, atmospheric pressure, and solar flares and high ozone concentrations. Alternative methods for recording observations made by SST aircraft and the dissemination of the reports are also briefly treated. A.C.R.

N69-31611 World Meteorological Organization, Geneva (Switzerland).
PROVISION OF METOROLOGICAL INFORMATION FOR PLANNING OF SST FLIGHTS
F. G. Finger and R. M. Mc Inturff *In its* Aeron. Meteorology 1969 p 406–433 refs (See N69-31576 17-20)
Avail: Issuing Activity

The need for accurate and timely weather forecasts for the transonic and cruise phases of SST flight, which have not been developed for lower level flights, and the importance of stratospheric meteorology in this area are discussed. Flight planning operations for supersonic transports are tentatively categorized into advanced planning (24 hours prior to estimated time of departure), preliminary planning (from 3 to 24 hours prior to departure), and preflight planning (from three hours to the actual takeoff time). For each of these categories, the trends in meteorological services offered are explored with a view to their relevance to SST operations. Among these are: (1) applications of satellite information; (2) implementation of the World Weather Watch, with its goal of improved coverage of worldwide conditions by 1970; (3) centralization of meteorological services; and (4) numerical weather analysis and prediction. A.C.R.

N69-31612 World Meteorological Organization, Geneva (Switzerland).
FORECASTS OF TEMPERATURE FOR SST OPERATIONS
R. F. Jones *In its* Aeron. Meteorology 1969 p 434–436 ref (See N69-31576 17-20)
Avail: Issuing Activity

Since it is anticipated that atmospheric temperature will be of greater significance in the economic operation of supersonic transports than with conventional aircraft, the requirements for temperature information and the current ability of existing meteorological methods and instruments to obtain them are discussed briefly. The operation of a SST is considered in four phases: takeoff, climb and transition, cruise, and transition to subsonic speed for descent. Variations in accuracy of established methods are analyzed for each of these phases. It was concluded that little difficulty is expected in meeting the requirement for cruising flight at heights of 100 mb and above, provided that accurate data are available at 50 mb, and later at 30 mb. Forecasts for the area within 250 mm of the airport in which transition to supersonic speed takes place, however, do not appear to be sufficiently accurate and require further refinement. A.C.R.

N69-31613 World Meteorological Organization, Geneva (Switzerland).
NOTE ON SOME TRIAL FORECASTS OF TEMPERATURE AT 100 mb AND 50 mb OVER THE NORTH ATLANTIC
C. L. Hawson *In its* Aeron. Meteorology 1969 p 437–447 (See N69-31576 17-20)
Avail: Issuing Activity

The problems involved in accurate temperature forecasting for regions of the atmosphere in which the supersonic transport will cruise led to a series of experimental forecasts at 100 and 50 mb during the winter of 1967/68. The results were compared with the associated RMS changes which occurred. For this purpose, the verifying data were taken to be the temperatures actually reported at the verifying times, if these were available. When they were not avaiable, temperature inferred from a time sequence or a synoptic space analysis were used in trials where they could be inferred with confidence to an error of about $\pm 1^{\circ}$C. Otherwise, the forecasts were omitted from the verification analysis. Individual forecast errors (at a level) for four stations were compounded to provide individual estimates of the forecast errors for the whole route and compared with the associated changes in temperature, similarly compounded for the route. For this purpose, route values were derived when three or all four stations were simultaneously available. Otherwise, the forecasts or changes were neglected in the analysis of errors. Author

N69-31614 World Meteorological Organization, Geneva (Switzerland).
WIND FORECASTS AT ALTITUDES OF 12 TO 24 km
M. G. Pogosyan and A. A. Pavlovskaja *In its* Aeron. Meteorology 1969 p 448–457 In RUSSIAN (See N69-31576 17-20)
Avail: Issuing Activity

Flight forecasts of wind conditions in the stratosphere are discussed, with emphasis on the importance of evaluating hemispheric temperature profiles, seasonal variations, and the interrelationship between conditions in higher and lower layers. Characteristics considered include: atmospheric circulation during cold weather, the periodicity and duration of splitting activity of stratospheric cyclone centers, the dynamics of warming trends in the stratosphere, the role of vertical atmospheric circulation, and the feasibility of forecasting geopotential fields and wind conditions in the lower stratosphere. Transl. by E.C.

N69-31630# Army Natick Labs., Mass. Earth Sciences Lab.
THE DISTRIBUTION OF THE LONGEST TEMPERATURE-DURATION IN A MONTH
David Sharon Dec. 1968 91 p refs
(AD-685827; ES-43; TR-69-35-ES) Avail: CFSTI CSCL 4/2

The statistical distribution of the longest uninterrupted duration of temperature above or below any given value was studied from hourly temperature records from 25 stations. The purpose was to examine the temperature duration variable from different aspects

aid to explore the problems involved in the development of a general distribution-model. Besides its value for the development of an empirical model, this information is also essential for the study of theoretical models. The distribution of temperature durations has been derived for some types of stations and can be used to make accurate predictions. The variability in these distributions has been reduced almost to the natural limit set by the variability in time inherent to durations in nature. This was achieved by reducing actual temperature values to a uniform standard scale and by stratifying the sample of stations. The distributional patterns of durations of high temperatures and of low temperatures are shown to be quite different from each other. The latter are considerably longer and, in winter, much more variable from year to year. Such differences must be reflected in any distribution model to be suggested, whether empirical or with some other basis. Author (TAB)

N69-31670# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

THE ATMOSPHERIC AEROSOL

L. Dufour Mar. 1969 52 p refs

Avail: CFSTI CSCL 4/2

The author discusses various aerosols present in the atmosphere, their formulation, their physical properties, distribution and volume concentration. TAB

N69-31679# Emmanuel College, Boston, Mass. Oriental Science Research Library.

A METHOD OF SETTING UP FINITE-DIFFERENCE SCHEMES FOR PREDICTION SCHEMES

Chung-hao Wang Mar. 1969 24 p refs Transl. into ENGLISH from Ch'i Hsiang Hsueh Pao (Peking), v. 35, no. 4, Nov. 1965 p 399–407

(Contract F19628-68-C-0251)

(AD-686200; EMM-68-181; AFCRL-69-0099; AFCRL-Trans-42) Avail: CFSTI CSCL 4/2

The paper presents two types of finite-difference schemes to represent the barotropic vorticity equation as an analogy to the principle of conservation of vorticity. The first type is conservative with respect to integration and can be separated into an explicit component which is conditionally stable and an implicit component which is unconditionally stable. The other type is equivalent to a quasi-Lagrangian model and is an explicit scheme which is entirely unconditionally stable. However, when necessary, the time-step in an unconditionally stable scheme may be extended to meet operational requirements. The evaluation of the wind field and the related problems on smoothing are discussed in relation to the computational requirements of each scheme. The discussion includes specifications of boundary and initial conditions. The numerical results given by the explicit forms are assessed by means of actual predictions and the evaluation of idealized fields. Author (TAB)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N69-30652# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.

EXPERIMENTAL STUDIES ON PREFERRED ORIENTATION OF POLYCRYSTALINE ICE BY UNCONFINED COMPRESSION

Okitsugu Watanabe and Hirobumi Ours *In its* Low Temp. Sci., Ser. A: Phys. Sci., No. 26 1968 p 1–28 refs In JAPANESE; ENGLISH summary (See N69-30651 17-13)

Avail: CFSTI

The grains in glacier ice have one or several preferred orientations. To clarify the process of formation of such orientations, some experimental studies were carried out in a cold room. Four kinds of snow and ice were compressed into ice, namely, naturally deposited snow with preferred orientation, artificially deposited snow without preferred orientation, ice with preferred orientation, and ice without preferred orientation. The orientation of snow and ice before compression does not affect the orientation of ice obtained by sufficient compression. At the final stage of compression, the fabric diagram of the ice shows four maxima patterns which resemble the diamond pattern of glacier ice. The internal structures of deformed ice are closely connected with the formation of preferred orientation. The gliding cell (eye shaped structure) and the shearing plane found by microscopic observation seem to be the most important structures related to preferred orientations of crystals. Author

N69-30747*# Northrop Corp., Huntsville, Ala.

NONLINEAR OPTIMAL GUIDANCE ALGORITHMS Interim Report

J. F. Andrus, I. F. Burns, and J. Z. Woo May 1969 153 p refs

(Contract NAS12-500)

(NASA-CR-86160; TR-792-9-547) Avail: CFSTI CSCL 17G

This report describes and compares a number of nonlinear guidance schemes that require information from a precomputed reference trajectory. However, it is not necessary that the space vehicle closely follow the nominal path. The methods are indirect in nature and are based on one step iterative techniques for solution of the nonlinear boundary equations. For each guidance command, the schemes require accurate evaluation of the functions g_i defining the boundary conditions. The derivatives of the functions g_i required in the iterative techniques are obtained cheaply by correcting precomputed derivatives corresponding to the reference trajectory. The guidance algorithms considered may be applied to a large variety of space missions, including those requiring bang–bang thrust magnitude control. In general, a broad class of guidance algorithms is described and this report selects one technique from this class which most efficiently solves the optimal guidance problem. Author

N69-30811*# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.

ANALYSIS OF A SYNTHETIC APERTURE RADIATING INTERFEROMETER NAVIGATION SATELLITE CONCEPT Interim Technical Report

Perry I. Klein May 1969 36 p refs

(Grant NGR-39-010-087)

(NASA-CR-103240; ITR-69-03) Avail: CFSTI CSCL 17G

This report describes and analyzes a synthetic aperture interferometer method of using satellites to provide navigating aircraft and ships with angular position information. The satellites transmit in the 1540 to 1660 MHz aeronautical mobile band. A navigation satellite experiment based on the synthetic aperture interferometer concept is recommended both as a means of demonstrating the concept and to learn more about propagation phenomena at these frequencies. It is found that the synthetic aperture interferometer navigation satellite concept is a very difficult one to implement successfully in an operational system because of the need to know the motion of the satellite and the user with extremely high accuracy. Moreover, very high-accuracy frequency standards are required both at the satellite and the user vehicle. Nevertheless, the concept is attractive because it offers the advantages of the already operational Navy Navigation Satellite System, without requiring many satellites for continuous coverage or long periods of time for a position fix. Author

N69-30888*# National Aeronautics and Space Administration, Washington, D.C.
RADIO NAVIGATION AIDS FOR AIR TRANSPORT
Krzysztof Mangel Jul. 1969 184 p refs Transl. into ENGLISH of the book "Urzadzenia Radionawigacyjne Komunikacji Lotniczej" Warsaw, Min. of Natl. Defence Press, 1964 p 1–180
(NASA-TT-F-12464; TT-67-56027) Avail: CFSTI CSCL 17G

Basic radio-engineering means of aircraft navigation and air-traffic control presently in use, is discussed, together with some solutions for future applications. The book is intended for engineers and technicians specializing in problems of radio navigation, and air-traffic personnel. It will also prove a valuable aid to students of technical universities as supplementary material for studying the principles of radio navigation and radiolocation. Author

N69-30946*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
FLIGHT INVESTIGATION OF A FLUIDIC AUTOPILOT SYSTEM
Wilton P. Lock and Shu W. Gee Washington Jul. 1969 32 p refs
(NASA-TN-D-5298) Avail: CFSTI CSCL 17G

A flight investigation was made of an experimental fluidic flight control system capable of various modes of operation, including altitude hold, heading hold, wings leveler, and turn control. The fluidic control system was tested in each mode at two flight conditions: cruise at 5000 feet, and cruise at 10,000 feet. Although stability problems were encountered early in the program, stable performance was achieved in each control mode for the flight conditions tested. High reliability was demonstrated, in that there were no failures with the fluidic elements themselves. Failures were experienced, however, with the mechanical portion of the mechanical fluidic components. Flight investigation revealed a number of areas in which improvement is needed before the system can be considered operational. Aircraft altitude changes caused noticeable changes in the null of the fluidic components, and gain reduction with increased altitude was experienced with sensors and amplifiers. Author

N69-31010# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
OPTIMAL INTERCEPT GUIDANCE FOR MULTIPLE TARGET SETS
Robert J. Norbutas Jan. 1968 209 p refs
(Contract NOw-66-0178-d)
(AD-675975; ESL-R-333) Avail: CFSTI CSCL 17/7

The problem of optimally guiding a vehicle to intercept more than one target is investigated. The major contributions are the following: (A) the extension of the variational calculus and two numerical algorithms (steepest-descent and Newton-Raphson) to multiple target set problems: and (B) the design of a suboptimal feedback controller for a specific problem of a vehicle intercepting two targets. The problems considered are in the form of n-point ($n > 2$) optimal control problems. Application of the calculus of variations results in a set of (n-1) two-point boundary value problems coupled through their boundary conditions. The additional boundary conditions are sets of intermediate transversality conditions in terms of discontinuities in the costate and Hamiltonian that are of the same form as the terminal transversality conditions. The steepest-descent and Newton-Raphson algorithms are extended to handle n-point optimal control problems. The modification of the steepest-descent algorithm involves the computation of an additional influence function for each intermediate state constraint, thereby increasing the computation time required per iteration proportionately. The Newton-Raphson algorithm is found to be inferior to the steepest-descent algorithm for computing optimal two target intercept trajectories because of the difficulty with which it handles free-time problems. Optimal intercept trajectories are computed for a particular two target missile guidance problem. Author (TAB)

N69-31186*# National Academy of Engineering, Washington, D.C. Aeronautics and Space Engineering Board.
AIR TRAFFIC CONTROL
Dec. 1968 71 p refs
(Contract NSR-09-012-912)
(NASA-CR-103230) Avail: CFSTI CSCL 17G

The final report of an advisory board to NASA and other government agencies on the state of air traffic control is presented. The board considered the state of regulation and control of departure, en route, and termination phases of civil air aviation. In it the deficiencies of present systems are characterized as well as an appraisal of funding decisions for research and development under the National Airspace System established under President Kennedy. The responsibilities of the Federal Aviation Administration in establishing systems improvements are described. Explicit recommendations were made for adapting the technology of present systems for a review of FAA capability to fulfill its commitments, and to update and implement the National Airspace Utilization Plan with projections of future needs, traffic patterns, and technology. M.H.E.

N69-31193# Texas Univ., Austin. Atmospheric Science Group.
ANALYSIS OF THE TEXAS COAST LAND BREEZE
David M. Feit Jun. 1969 61 p refs
(Grant NSF GA-367X1)
(Rept-18) Avail: Issuing Activity

Wind and temperature data taken during three days of land breeze occurrence are analyzed. Data were obtained using two 28 meter collapsible towers in conjunction with a series of automatic meteorological recording stations, instrumented captive balloons, and instrumented aircraft. The land breeze was found to have its source more than 16 km inland. The depth of the land breeze was observed to be on the order of 100 meters. It was found to have a decided tendency to be intermittant with cycles of offshore winds followed by periods of relative calm. Onshore acceleration of the 28 meter wind was noted prior to the passage of the land breeze. Author

N69-31227*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
METHODS FOR PREDICTING SPACECRAFT-WINDOW-INDUCED LINE-OF-SIGHT DEVIATIONS
Kenneth C. White and Burnett L. Gadeberg Washington Jul. 1969 34 p refs
(NASA-TN-D-5238) Avail: CFSTI CSCL 17G

Methods have been developed for predicting angular line-of-sight deviations induced by spacecraft windows. The description of the window surface shape requires an accurate knowledge of the flatness distribution over the whole window surface, the parallelism between the surfaces of the window, and the surface deformation due to pressure loading. The window surface flatness distribution and the parallelism between surfaces are determined from interference photographs of the window. Pressure deformations of windows with known edge support conditions are computed by means of known analytical solutions or a finite element structural analysis computer program. Pressure deformations of windows with unknown edge conditions are determined experimentally from interference photographs of the window surfaces. The prediction methods were used to compute the line-of-sight (LOS) deviations for a Gemini spacecraft window. The computed LOS deviations were compared with experimentally measured LOS deviations to assess the validity of the methods developed. A detailed statistical analysis of the differences between computed and experimentally measured data indicated that the results agreed to within 2 arcsec mean difference and 4 arcsec standard deviation. Author

N69-31270# National Weather Records Center, Asheville, N.C. Environmental Data Service.
CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 5: BOSTON, MASSACHUSETTS, GENERAL F. L. LOGAN INTERNATIONAL AIRPORT Final Report
Jun. 1969 34 p
(Contract FA-67-WAI-129)
(SRDS-RD-69-22-Vol(5)) Avail: Issuing Activity

Tabulated data covering the period 1 January 1956 to 31 December 1965 are presented for the Boston airport. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Weather and landing system categories are tabulated as aids for making decisions affecting landing system and fog dissipation at the air terminal. Author

N69-31271# National Weather Records Center, Asheville, N.C. Environmental Data Service.
CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 6: BUFFALO, NEW YORK, GREATER BUFFALO INTERNATIONAL AIRPORT Final Report
Jun. 1969 35 p
(Contract FA-67-WAI-129)
(SRDS-RD-69-22-Vol-(6)) Avail: Issuing Activity

Tabulated data covering the period 1 January 1956 to 31 December 1965 are presented for the Buffalo airport. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Weather and landing system categories are tabulated as aids for making decisions affecting landing system and fog dissipation at the air terminal. Author

N69-31351*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
STRAPDOWN NAVIGATION EQUATIONS FOR GEOGRAPHIC AND TANGENT COORDINATE FRAMES
Kenneth R. Britting Jun. 1969 29 p
(Grant NGR-22-009-229)
(NASA-CR-103296; RE-56) Avail: CFSTI CSCL 17G

Six coordinate frames relevant to the operation of radar-aided strapdown inertial navigation system are defined and the relationships between these frames are established. Analytic expressions for the specific force are derived for the cases of computation in the local geographic frame and in the tangent coordinate frame. An algorithm for the solution of the direction cosine matrix is indicated. Approximate analytic relations are derived which relate the change in latitude and longitude to the radar coordinates. Author

N69-31354*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
COMPUTATION FRAMES FOR STRAPDOWN INERTIAL SYSTEMS
William Robert Killingsworth, Jr. (M.S. Thesis) Jun. 1968 77 p refs
(Grant NGR-22-009-229)
(NASA-CR-103295; TE-28) Avail: CFSTI CSCL 17G

Three configurations of a strapdown navigation system are analyzed to determine the effect of mechanizing different computation frames. For systems computing in the navigation frame and in an inertial frame, a linear analysis is developed. These linear theories are verified as accurate analytical descriptions of the systems by a computer solution of the system differential equations by numerical methods. Gyro drift and torquing uncertainty are found to be the predominant error sources. In the system computing in the geographic frame, these two error sources result in bounded latitude error but unbounded longitude error. For inertial frame computation these two error sources result in unbounded errors for both longitude and latitude. Author

N69-31381*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
ON THE ENGINEERING PORTION OF A RESEARCH PROGRAM: TO PERFORM A GYRO TEST OF GENERAL RELATIVITY IN A SATELLITE AND DEVELOP ASSOCIATED CONTROL TECHNOLOGY
Robert H. Cannon, Jr., Benjamin O. Lange, and Daniel B. De Bra Nov. 1968 31 p refs
(Grant NGR-05-020-019)
(NASA-CR-103318; SASR-10) Avail: CFSTI CSCL 17G

The cooperative engineering effort has continued to concentrate on the engineering design aspects of the gyro and telescope readouts, and the conceptual development of the electronics, instrumentation and attitude control systems. The telescope simulator is currently being modified to give improved light transmission. The attitude control studies have led to an extremely interesting and promising new concept for improving the pointing accuracy of the gyrotelescope structure by means of an inner servo-loop driven by a superconducting actuator within the cyrogenic environment. Important progress was also made in the thruster mechanization for the attitude control jets, and a test chamber was designed and constructed for evaluating valve performance in the laboratory. Author

N69-31666# Ohio Univ., Athens. Dept. of Electrical Engineering.
ALL-WEATHER, LOW-LEVEL NAVIGATION Annual Report, 25 Sep. 1967–25 Sep. 1968
Richard H. Mc Farland Fort Monmouth, N.J. ECOM Feb. 1969 175 p refs
(Contract DAAB07-68-C-0084)
(AD-685858; AR-1; ECOM-0084-1) Avail: CFSTI CSCL 17/7

The system expected to provide navigation capability for all-weather low altitude flight has been identified in simplified block form. Two components, the navigation information processor and the computer processor have been determined as requiring the major portion of this research effort. Three methods of attack for solving the problems have been employed. First, state-of-the-art has been ascertained together with a critical analysis of claims made by contemporary designs. Second, special consideration has been given to modifying present systems in order that they more nearly fill the requirements imposed by the low-level flight regime, and third, consideration has been given to ideas generated within and without of this organization for future development and implementation. Answers to the problems of geometries, definitions, and requirements of information transfer displays have been obtained. Tentative agreement on development of timing techniques to provide for accurate range-range measurements has been reached as the method to implement for low altitude navigation. Author (TAB)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N69-30519*# Scripta Technica, Inc., Washington, D.C.
APPROXIMATE THERMAL SIMULATION OF CYLINDRICAL FUEL-ELEMENT RODS
P. A. Ushakov *In its* Liquid Metals May 1969 p 136–148 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 18J

The author uses dimensional analysis and other analytical tools to arrive at methods of simulation of thermal conditions of fuel rods in liquid-metal cooled nuclear reactors. The presented methods are successfully used in simulation of actual reactor cores. Author

N69-30521*# Scripta Technica, Inc., Washington, D.C.
EXPERIMENTAL STUDY OF TEMPERATURE FIELDS OF FUEL ELEMENTS, USING MODELS
A. V. Zhukov et al *In its* Liquid Metals May 1969 p 170–189 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 18J

Results of an experimental heat transfer study with simulated fuel elements are presented and analyzed. Hexagonal housings were used and the peripheral elements were found to undergo appreciable temperature variations. These temperature variations are analyzed for different packing modes. Transient coolant flow was also studied with the attendant effects on rod temperature. Tinning with fuel elements is considered in turbulent and laminar flow. Author

N69-30559# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
THE EDEN AND EDEN PRIME CODES FOR HETEROGENEITY CALCULATION IN FAST REACTORS
G. Bitelli, I. Dal Bono, and V. Leproni 1969 19 p refs
(RT/FI(69)1-PRV-r(68)26) Avail: CFSTI

The EDEN and EDEN* codes give the fine structure of the real and adjoint flux in lattices of fast reactors and the reactivity variation due to heterogeneity effects. Author

N69-30569# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
CALCULATIONS OF THE SPECIFIC POWER IN SOME IRRADIATED MOCK-UPS IN THE RITMO REACTOR [CALCOLI DI POTENZA SPECIFICA IN ALCUNI MOCK-UPS IRRAGGIATI NEL REATORRE RITMO]
R. Conversano, G. Cosoli, and G. Valle 1969 21 p refs In ITALIAN
(RT/FI(69)14) Avail: CFSTI

Irradiations of two series of mock-ups containing, respectively, UO_2 rods, 25% enriched in U^{235}, and B_2O_3 natural UO_2 rods with the same macroscopic absorption cross-section have been carried out in the central cavity of the RITMO reactor at CNEN, Casaccia. The calculation method of the specific power generated in the mock-ups is described. Author

N69-30573# Kernforschungsanlage, Juelich (West Germany). Institut fuer Reaktorentwicklung.
STUDY OF THE LOAD BEHAVIOR OF THE THORIUM HIGH-TEMPERATURE REACTOR (THTR) 300 MW PROTOTYPE POWER PLANT [STUDIE ZUM LASTVERHALTEN DES THTR 300 MW-PROTOTYPKRAFTWERKES]
Ulf Hansen Jan. 1969 166 p refs In GERMAN
(Jul-571-RG) Avail: CFSTI

A quasi-stationary mathematical model is developed for computing the effect of the daily and weekly load fluctuations on the operation of the power plant. With this model, the gradually occurring changes in load demands can be determined under the assumption that the time dependence of this process can be described by a series of consecutive stationary conditions. The model reflects the connection between nuclear and thermodynamic processes in the reactor core as well as the interdependence of the primary and secondary circuits. The power output can be given in the form of any series of successive changes occurring either in a step-like or ramp-like manner. The load-dependent fluctuations in the xenon concentration are calculated as functions of time and space. The behavior of the total plant for various partial load conditions and for a number of special load diagrams is examined. The model is designed for computer processing. Transl. by K.W.

N69-30574# Kernforschungsanlage Juelich (West Germany). Zentrallabor fuer Elektronik.
A DETECTOR ARRAY WITH LOCAL RESOLUTION FOR NEUTRON SCATTERING EXPERIMENTS [EINE ORTSAUFLOESENDE DETEKTORBANK FUER NEUTRONENSTREUEXPERIMENTE]
Klaus Abend Mar. 1969 93 p refs In GERMAN
(Jul-582-ZE) Avail: CFSTI

Development and construction of a large-area array for the simultaneous detection of neutrons in a small-angle scattering apparatus are described. After considering several design alternatives for detector arrays, the construction of a detector area using proportional counters is explained. The principle of local resolution as used in this work is unique in neutron detection. The 60-cm-long proportional counters are filled with BF_3 and have a resistance wire as a collector. Six in-parallel counters were used to form a detector area of 60 × 30 cm^2. The localized information of each counter was stored on-line in a small digital computer. The computer also controlled the experiment. It was found that the proportional counters with resistance wire registered a poor impulse height spectrum. The accuracy of the linear determination between locally recorded signal and real incidence of the radiation was better than ±0.15 cm. Detection probability for 7 Å neutrons with optimized discrimination threshold was 65%, with deviations of <1% along the counter. The electronic system is capable of processing periodic impulse rates of 85 kHz. Transl. by K.W.

N69-30575# Kernforschungsanlage Juelich (West Germany). Institut fuer Reaktorentwicklung.
PHYSICAL STUDIES ON THE DEUTERIUM OXIDE MODERATED THORIUM REACTOR [PHYSIKALISCHE UNTERSUCHUNGEN ZUM D_2O-MODERIERTEN THORIUMREAKTOR]
J. Darvas, U. Hansen, and E. Teuchert Apr. 1969 92 p refs In GERMAN
(Jul-584-RG) Avail: CFSTI

Detailed results of a study for a D_2O thorium converter are presented based on the design of a pressure vessel reactor with the burner elements arranged in an open lattice. A parametric study was performed for various reactor core configurations. The neutron physics of the burn process and the reaction, loading, and regeneration were simulated by computer. Calculations for a prolonged period of operation result in balanced core, in which the burnout cycle of each loading period is approximately constant. The balanced cycles thus obtained are used with different sets of core parameters for a fuel cycle cost study. In addition, the conversion characteristics are optimized. Two facilities, one of 300 MWe and one of 600 MWe capacity, are used for detailed calculations. The study of the 300-MWe facility provides sufficient data for the construction of a prototype. Transl. by K.W.

N69-30582# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
THE CRAC CODE (COUPLED REACTOR ANALYSIS CODE)
M. Salvatores 1969 10 p refs
(RT/FI(69)8-PRV-r(68)23) Avail: CFSTI

The CRAC code calculates real and adjoint fluxes and K_{ij} and l_{ij} coupling parameters according to Avery's theory for coupled reactors, as well as generalized sources to be used in perturbation analysis of coupled systems. Author

N69-30589 Illinois Univ., Urbana.
THE APPLICATION OF THE KINETICS EQUATIONS SOLVED IN TEMPERATURE TO THE SHORT-INTERVAL SERIES PULSING OF A TRIGA REACTOR
Harold Albert Kurstedt, Jr. (Ph.D. Thesis) 1968 296 p
Avail: Univ. Microfilms: HC $13.50/Microfilm $3.80 Order No. 69-1377

The technique of short-interval series pulsing a thermal reactor was studied both experimentally and theoretically. Oscillations in the pulse amplitudes occur near the beginning of a series due to a delicate balance between the residual temperature entering a pulse and its amplitude. These oscillations damp out rapidly, giving an equilibrium pulse height. It was found that the equilibrium pulse amplitudes are strongly affected by the pulse rod reactivity, the rod drop time, and the time interval between pulses. A unique method of analysis involving the reactor kinetics equations solved in temperature was developed. This provides a specialized technique allowing rapid calculation of the temperature history in the reactor. The solution, based on a point kinetics–temperature model, uses the concept of a pseudo temperature. The resulting analytic model and the code developed to solve it show excellent agreement with the experimental results from the Triga Reactor. Dissert. Abstr.

N69-30605 Illinois Univ., Urbana.
SPACE-TIME KINETICS FOR HOMOGENEOUS AND HETEROGENEOUS REACTOR MODELS
Genn Saji (Ph.D. Thesis) 1968 183 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 69-1432

An investigation is described of the excitation of higher space modes in reactor transfer function measurements. An explicit time-dependent two-group flux, expressed by a series of space modes, is established when a forced oscillation is applied to a reactor. The self-consistent time-dependent method developed herein minimizes necessary mathematical transformations, and enables one to clearly visualize the physical reasons why the higher space modes are only excited at high frequencies. The conditions necessary for a particular higher space mode to be appreciably excited and detected are discussed in detail. The results show that the major factor is due to the increase of the input frequency as compared with the decay constants of several higher space modes at high frequencies. This method was applied to the Nora reactor for which the space-dependent transfer functions have been measured. Dissert. Abstr.

N69-30623# Kernforschungsanlage Juelich (West Germany). Institut fuer Festkoerper- und Neutronenphysik.
CONSTRUCTION OF A FACILITY FOR ELECTRON IRRADIATION AT LOW TEMPERATURES [AUFBAU EINER ANLAGE ZUR BESTRAHLUNG MIT ELECTRONEN BEI TIEFEN TEMPERATUREN]
Johann Hemmerich Mar. 1969 62 p refs In GERMAN
(Jul-579-FN) Avail: CFSTI

Described is a high production rate electron irradiation facility that uses direct contact helium cooling to obtain defect densities and homogenous defect distributions in crystal lattices. The electron source of a Van de Graaff accelerator, modified by a quadrupole lens system, reaches flux densities of 100A/cm^2 at a homogeneity of $\geq$10% over a 2 cm^2 probe surface area. Low temperature irradiations of platinum and copper probes induce a defect concentration of 2.7 $\times$ 10^{-3} in the first, and of 2.4 $\times$ 10^{-3} in the latter material. The linear decrease of the damage rates in both samples at higher defect concentrations is attributed to spontaneous recombinations of newly created defects with already existing defects; sub-threshold radiation annealing effects also direct enough energies to closely spaced Frenkel pairs to insure their recombinations. Transl. by G.G.

N69-30626# Kernforschungsanlage Juelich (West Germany). Zentralabteilung Strahlenschutz.
AIR MONITORING METHODS AND THEIR APPLICATION IN THE VICINITY OF THE JUELICH NUCLEAR RESEARCH FACILITY [MESSMETHODEN DER LUFTUEBERWACHUNG UND IHRE ANWEDUNG BEI DER UMGEBUNGSUEBERWACHUNG DER KERNFORSCHUNGSANLAGE JUELICH]
K. J. Vogt Dec. 1968 43 p refs In GERMAN
(Jul-S66-ST) Avail: CFSTI

Radioactive aerosol, radio iodine, and tritium inhalation load factors are obtained by monitoring potential contamination propagation patterns in the vicinity of a nuclear reactor facility. The most important aerosol sample absorption and evaluation methods are discussed, and fixative filtration processes as well as band filtration instruments are outlined. Briefly described is the detection of submersive dosage and the ingestion risk from radioactive fallout on the ground. Included is a short review of the air monitoring system for the Nuclear Reactor Center in Juelich. Transl. by G.G.

N69-30759# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
FEASIBILITY STUDY OF PROBE-TYPE LIQUID METAL FLOWMETERS FOR FTR SUBASSEMBLIES
H. L. Libby and J. D. Jensen Feb. 1969 52 p refs
(Contract AT(45-1)-1830)
(BNWL-911) Avail: CFSTI

Results of a feasibility study of probe-type liquid metal flowmeters are presented. A comparison of inside-channel eddy current flowmeters and inside-channel eddy current ultrasonic flowmeters indicates that the eddy current flowmeter is most suitable for the proposed application in the FTR subassemblies. Experimental results using liquid Wood's alloy as the liquid metal medium indicate a sensitivity of 18 μV/ft/sec velocity per volt bridge drive for 1 in. diameter eddy current probe. Low impedance makes the eddy current probe compatible with cabling able to withstand radiation levels encountered in the reactor environment. Author (NSA)

N69-30760# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
FISSION PRODUCT INVENTORY AND DECAY HEAT ASSOCIATED WITH FTR FUEL
W. L. Bunch and L. D. O'Dell Feb. 1969 76 p refs
(Contract AT(45-1)-1830)
(BNWL-981) Avail: CFSTI

The fission product inventory and the decay heat associated with driver fuel irradiated to goal exposure (45,000 MWd per metric ton) in the Fast Test Reactor is presented, based on calculations using the computer code RIBD with a nuclear data library prepared for the FTR environment. Curie inventories as a function of decay time are given for each of about 350 isotopes or isomeric states generated by the fast-neutron induced fission of either ^{239}Pu or ^{238}U, by down-chain decay, or by subsequent neutron capture. Beta, gamma, and total decay power are given in percent of operating power for decay times from 1 sec to about 10 years.

Uncertainty in the decay heat calculations, based on propagation of the uncertainties associated with input nuclear data, is estimated. The uncertainty is calculated to be less than ±10% for the first 10 days, and less than ±20% over a 10-yr decay period.
Author (NSA)

N69-30810# Brookhaven National Lab., Upton, N.Y.
BROOKHAVEN PULSED FAST RESEARCH REACTOR
J. M. Hendire, K. C. Hoffman, H. J. C. Kouts, R. J. Parsick, J. P. Phelps, et al Jan. 1969 69 p refs Presented at Fast Burst Reactor Natl. Topical Meeting, Albuquerque, N.Mex. Sponsored by AEC
(BNL-13208; CONF-690102-2) Avail: CFSTI

The repetitively pulsed fast reactor is of interest as a high intensity source for neutron beam experiments. The design characteristics of a conceptual pulsed reactor operative at an average power of 30 MW are discussed. The peak power during a pulse is about 4,700 MW and the pulse width at half-maximum power is 90 microseconds. The reactivity is varied by means of reflector sections carried past a bare face of the core on high speed rotors. A two-rotor system is preferred in order to provide for variation of the repetition rate between 20 and 60 pulses/sec. The performance of the system described is limited by the ability of the fuel to withstand the cyclic thermal and inertial stresses caused by power pulsing. The high cycle fatigue strength of a cermet fuel with a Mo matrix was determined in the unirradiated condition and these data were used as the basis for the core design.
Author (NSA)

N69-30822# European Atomic Energy Community, Ispra (Italy).
FABRICATION METHODS FOR AND STUDY OF SANDWICHES FOR THERMIONIC CONVERTERS [HERSTELLUNGSVERFAHREN UND UNTERSUCHUNG VON MEHRSCHICHTROHREN FUER THERMIONIK-KONVERTER]
P. Fiebelmann Brussels Jun. 1969 23 p refs In GERMAN, ENGLISH summary
(EUR-4239.d) Avail: CFSTI

A survey is given on sandwiches intended to be used for different thermionic reactor concepts. Fabrication methods are mentioned. Some of the main features are tabulated. Characteristic values are recommended for sandwiches. Tests carried out at Euratom, Ispra, are discussed.
Author

N69-30895# European Atomic Energy Community, Ispra (Italy). Scientific Data Processing Center
CALCULATIONS OF THE EPITHERMAL NEUTRON SPECTRA IN THE LENA (TRIGA MARK 2) REACTOR AND DETERMINATION OF THE COBALT RESONANCE CAPTURE INTEGRAL
G. Gaggero, I. Lesca, A. M. Bresesti, M. Bresesti, and E. Orvini (Pavia Univ.) Brussels 1969 20 p refs
(EUR-4227.e) Avail: CFSTI

Calculations of epithermal nuetron spectra in a Triga Mark II reactor, were performed utilizing the DTK neutron transport code and the GAZE neutron diffusion code. The calculations have shown the presence of a neutron spectrum closely approximating $\frac{1}{E}$ in the 0.68 eV – 2.05 KeV energy region, in some positions of the water and graphite reflectors. In these positions a value of 71.9 ± 3.5 barns was measured for the cobalt resonance capture integral by activation techniques.
Author

N69-30947# Brown, Boveri und Cie, A. G., Mannheim (West Germany).
NON-DESTRUCTIVE TESTING OF FUEL ELEMENTS IN PEBBLE-BED REACTORS [LE CONTROLE NON DESTRUCTIF DES CARACTERISTIQUES D'ELEMENTS COMBUSTIBLES DANS UN REACTEUR A ELEMENTS SPHERIQUES]
W. Rausche Brussels Euratom 1969 37 p refs In ENGLISH and FRENCH Presented at the 12th Met. Congr., Saclay, France, 24–26 Jun. 1968
(EUR-4237.f,e) Avail: CFSTI

The core of high temperature reactors is made up of a pebble-bed of spherical mobile fuel elements. During operation these elements are continuously circulated. Optimally burnt-up or defect elements are discharged and replaced by new elements. All other elements are fed back to different regions of the core according to their neutron-physical characteristics. The fuel handling mechanical and nuclear properties of the elements. Four special methods are presented here which allow a determination of such important characteristics as geometrical integrity, mass, Young's modulus, gamma-activity, burn-up, and overall neutron-physical behavior.
Author

N69-30993# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf.
ASTRA FLUX CALCULATIONS WITH LARGE SCALE COMPUTER PROGRAMS
H. Bruneder, J. Harrington, D. Bochskanl, and F. Putz Dec. 1968 25 p refs Submitted for publication
(SGAE-R-3/1968; SGAE-MA-1/1968) Avail: CFSTI

In connection with proposed changes in the core reflector and beam tubes of the ASTRA-Reactor, it was necessary to calculate for a variety of different fuel-reflector configurations the neutron flux distribution as a function of energy. Recently, a number of large digital computer codes capable of handling these calculations have become available for use. The distribution primarily sought are: (1) the thermal neutron flux distribution parallel to the beam tubes; and (2) the ratio of thermal to fast neutrons along the same axis. The purpose of this report is to describe the methods used, present the results obtained and describe some of the peripheral aspects of the calculation and the results. In addition the influence of various reflector materials and thicknesses was investigated and is covered in this report.
Author

N69-30996# Kernforschungsanlage Juelich (West Germany). Institut fuer Reaktorbauelemente.
APPARATUS AND RADIOCHEMICAL METHODS FOR URANIUM LEACH TESTS OF IRRADIATED COATED PARTICLES [APPARATUERN UND RADIOCHEMISCHES VERFAHREN FUER URAN-LEACHTESTS BESTRAHLTER BESCHICHTETER PARTIKELN]
Markus Stoeppler Dec. 1968 21 p refs In GERMAN
(Jul-568-RB) Avail: CFSTI

Described is the leaching system for 0.1 g irradiated highly active coated fuel particles in a 10 cm lead cell. The sample containing tube serves also as solvent container so that cell interior contamination is kept to a minimum. Acid additions and cleaning of the apparatus take place outside the cell. Also described in detail is the decontamination procedure for the resulting radioactive solvents by ion exchange reactor; extracted uranium quantities from solutions and decontamination processes are shown in tables.
Transl. by G.G.

N69-30997# Kernforschungsanlage Juelich (West Germany). Institut fuer Reaktorwerkstoffe.
STUDIES ON THE PRODUCTION OF SPHERICAL FUEL PARTICLES BY A SOL-GEL METHOD [UNTERSUCHUNGEN ZUR HERSTELLUNG KUGELFOERMIGER BRENNSTOFFTEILCHEN NACH EINEM SOL-GEL VERFAHREN]
R. Foerthmann, A. Naoumidis, and H. Nickel Mar. 1969 45 p refs In GERMAN
(Jul-583-RW) Avail: CFSTI

After a detailed description of the stages of the sol-gel-process and the well-known sol-gel-processes for the preparation of kernels of uranium oxide, thorium oxide, plutonium oxide and mixtures of

these oxides a report given about experimental investigations which led to the development of a new sol-gel-process. By the application of the internal gelation in the preparation of spherical gel particles from a suitable UO_2 sol it was possible to obtain high-density UO_2 microspheres with diameters up to 1000/um. The procedure for the separate stages i.e. sol preparation, gelatin of sol to spherical particles drying and sintering and the equipment employed therein are described. This process is also suitable for the preparation of $(U,Th)O_2$ and ThO_2 microspheres. The sols and gels prepared are characterised by chemical analysis, measurement of viskosity, the determination of crystallite size from X-ray linebroadening and electron-microscopy. Author

N69-30998# Kernforschungsanlage Juelich (West Germany). Institut fuer Reaktorwerkstoffe.
TENSILE STRESS ESTIMATION ON COATED PARTICLES PRESSED IN THE SHELL [ABSCHAETZUNG DER SPANNUNGEN IN DER HUELLE GEDRUECKTER BESCHICHTETER PARTIKELN]
W. Delle, K. Drittler, G. Haug, and H. Schiffers Jan. 1969 33 p refs In GERMAN
(Jul-589-RW) Avail: CFSTI

The theory of elastic shells is used to calculate tensile stress in the outer layers of coated particles compressed between two surfaces. Developed is a formula for determining breaking stress from fracture strength and geometric particle measurements. Experimental data on particles with pyrographic coatings show good agreement with compression test results on pyrolytic carbon platelets. Transl. by G.G.

N69-31043# Army Electronics Command, Fort Monmouth, N.J.
METHOD OF CALCULATING RADAR REFLECTIVITY OF NUCLEAR CLOUDS
Raymond L. Robbiani Nov. 1968 29 p refs
(AD-684918; ECOM-3049) Avail: CFSTI CSCL 18/3

A method for calculating radar reflectivity of nuclear clouds is discussed. Assumptions relating cloud characteristics and data collection are explained and tables and curves depicting these data are presented. The calculation derives reflectivity by generating particle and moisture unit volumes of estimated reflectivity using collection data from previous tests and fall-out prediction studies. Author (TAB)

N69-31045# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
EVALUATION OF ISOTOPIC DILUTION METHOD USED FOR DESTRUCTIVE ANALYSIS OF IRRADIATED FUELS
R. P. Matsen [1968] 14 p
(Contract AT(45-1)-1830)
(BNWL-CC-669) Avail: CFSTI

Twenty-seven samples cut from three rods of a conventional 19-rod PRTR cluster were destructively analyzed for uranium content and Pu/U ratios by two independent techniques. The first involved alpha counting and gravimetric methods. The second used isotope dilution techniques. Values obtained by the two methods are compared. The plutonium content was given accurately by either method, but further effort is needed to obtain more reliable uranium values. NSA

N69-31081# European Atomic Energy Community, Ispra (Italy). Reactor Physics Dept.
CAN THORIUM COMPETE WITH URANIUM? AN ASSESSMENT FOR HEAVY-WATER AND GRAPHITE MODERATED REACTORS
G. Graziani, C. Rinaldini, C. Zanantoni, J. J. Devos, and M. Paruccini May 1969 70 p refs
(EUR-4264.e) Avail: CFSTI

The cost of thorium fuel cycles with fully enriched uranium make-up and of natural and enriched uranium fuel cycles was investigated for D_2O moderated pressure tube and pressure vessel reactors and high-temperature gas-cooled reactors. The fuel cycle cost was optimized by a parametric investigation of burn-up, specific power and moderation ratio. A continuous charge-discharge fueling was assumed, with full recycle, partial and segregation schemes. The comparison between the fuel cycle costs of the uranium and thorium cycle shows a slight advantage for thorium under present economic conditions. The economic conditions which should be realized in order to make thorium more competitive are investigated by means of a parametric survey of the cost of fabrication, reprocessing, ore and separative work. Author

N69-31111# European Atomic Energy Community, Ispra (Italy).
PINOCCHIO: A COMPUTER PROGRAM FOR CELL REACTIVITY CALCULATIONS
L. Amyot, G. Casini, R. Cuniberti, and C. Daolio Brussels Apr. 1969 129 p refs
(EUR-4231.e) Avail: CFSTI

The code PINOCCHIO solves the eigenvalue problem for the infinite lattice and evaluates the variation of reactivity as a function of time for a unit cell. The integral transport equation is solved in a multigroup structure using the first collision probability formalism. Both single rods and cluster-type fuel elements are treated. The machine-time on the IBM-360 is typically of the order of 1-3 minutes per time-step. The various hypotheses underlying the model and the main features of the computer program are explained. Author

N69-31119# European Atomic Energy Community, Ispra (Italy).
PYROMETALLURGICAL CONCENTRATION OF ENRICHED URANIUM IN IRRADIATED MTR FUEL ELEMENTS [CONCENTRATION PYYROMETALLURGIQUE DE L'URANIUM ENRICHI DANS LES ELEMENTS COMBUSTIBLES MTR IRRADIES]
C. David, J. M. Junger, R. Lorenz, P. Montellanico, and J. G. Wurm Brussels May 1969 20 p In FRENCH; ENGLISH summary Presented at Symp. on Dry Reprocessing, Mol, Belgium, 28-29 Oct. 1968
(EUR-4243.f) Avail: CFSTI

The purpose of this process to be performed on the MTR reactor site, is to reduce: (1) the transportation costs of the uranium to the aqueous plant; and (2) the processing costs (reduced handling smaller liquid waste volume). This method consists in melting down the fuel element (aluminum type) and concentrating the fissile material by precipitation through the addition of magnesium in which uranium is insoluble. The enriched uranium, concentrated at the bottom of the ingot as an intermetallic compound is cut off and shipped away. The laboratory experiments indicated that an uranium volume concentration of 20:1 is possible. A furnace was installed in the hot cell of the Ispra I reactor to melt spent MTR fuel elements. The first experiments performed on MTR dummy elements have demonstrated that the same results as for the laboratory experiments can be obtained. Author

N69-31122# Brookhaven National Lab., Upton, N.Y.
ANALYSIS OF MULTIDIMENSIONAL THERMOELASTIC DYNAMIC RESPONSE OF REACTOR FUEL ELEMENTS
Morris Reich and Bernard Koplik (Polytech. Inst. of Brooklyn) Nov. 1968 69 p refs Supported by AEC
(BNL-13311) Avail: CFSTI

A detailed finite difference method for determining the dynamic response of pulsed reactor fuel elements that is based on the exact theory of elasticity is described. The advantage of this method is that the numerical solution can describe approximately any elastic wave propagation problem for a semi-infinite bar to a thin circular plate. NSA

N69-31138# California Univ., Livermore. Lawrence Radiation Lab.
NEW ASTRON ACCELERATOR AND MAIN CHAMBER
Charles A. Hurley 21 Mar. 1969 12 p ref. Presented at Symp. on Eng. Probl. of Fusion Res., Los Alamos, N. Mex., 8–11 Apr. 1969 Sponsored by AEC Submitted for publication
(UCRL-71539; CONF-690407-1) Avail: CFSTI

Astron has gone through a remodeling period in which the main trapping chamber and the linear-induction electron accelerator were completely redesigned. Greater operating reliability combined with mechanical flexibility and accuracy were the desirable qualities included in the design criteria of the main trapping chamber. This chamber consists of an aluminum vacuum chamber approximately 90 ft long 63 in. o.d., with 4-in.-thick water-cooled walls, supports an infinite solenoid coil system of 1100 gauss at the center, and accommodates 250 diagnostic port penetrations. The inside diameter of the chamber is lined with resistors made of 0.0015-in. tungsten wire. The chamber can be aligned to within 0.040-in. in length and can be moved by floating on a thin film of air. The primary electronic requirements for the new accelerator were to increase the current output from 400 to 1000 amp, to include additional space for the diagnostics and monitoring, and to increase the energy above 4 MeV. Author (NSA)

N69-31161# Kernforschungszentrum, Karlsruhe (West Germany).
PHYSICS INVESTIGATIONS OF URANIUM-FUELED FAST STEAM-COOLED REACTORS IN SNEAK, ASSEMBLIES 3A-0, 3A-2, 3A-3
R. Schroeder, comp. Oct. 1968 87 p refs Sponsored by US-EURATOM
(EUFNR-608; KFK-847; EUR-3721.e) Avail: AEC Depository Libraries

Experiments on the SNEAK-3A series of assemblies are described for the physics characteristics of fast steam-cooled uranium reactors of about 500 l core volume at operating steam density. The steam was simulated by polyethylene foils. Two of the assemblies, corresponding to 40% (3A-1) and to 100% (3A-2) of the normal coolant density, have been investigated in considerable detail. Two more assemblies, investigated in less detail, have been obtained by voiding part of the core of assembly 3A-1 (viz. 3A-0) and by doubling the thickness of the polyethylene foils in part of the core of assembly 3A-2 (viz. 3A-3). The experiments done at assembly 3A-0 and those done at assemblies 3A-2 and 3A-3 are discussed. Many of the experimental data are of direct interest to the designer of a steam-cooled fast breeder reactor, e.g., the critical mass, the reactivity coefficient of the coolant density and the ratio of the capture rate of ^{238}U to the fission rate of ^{235}U as a function of position, that is closely related to the breeding ratio. Author (NSA)

N69-31164# Atomic Energy Establishment, Winfrith (England).
ANALYSIS OF REACTIVITY MEASUREMENTS IN HECTOR ON SINGLE PLUTONIUM–URANIUM OXIDE CLUSTERS
R. C. Bennerman Aug. 1968 121 p refs
(AEEW-R-499) Avail: CFSTI: HMSO 16s

A series of reactivity perturbation measurements was carried out in the HECTOR reactor on single PuO_2–UO_2 clusters. These clusters were 14 in. long, and contained up to 2% Pu with a ^{240}Pu content from 3% to 26%. These Pu contents cover the range encountered both in burn-up and in possible Pu enrichment of an A.G.R. A method of analyzing the measurements was developed, which used as a starting point reaction rates produced by any suitable single-cell lattice code. A comparison between the measured and calculated reactivity perturbations for a given single Pu-bearing cluster then provides a measure of the accuracy of k-infinity calculated by that code for a complete lattice containing that particular fuel. The experimental results were analyzed using reaction rates obtained from the ARGOSY-4 code. Good agreement was found between calculated and measured reactivity perturbations for all samples. Author (NSA)

N69-31170# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
CRAYON G1: A CODE FOR THE CALCULATION OF THE IRRADIATION BEHAVIOUR OF FUEL RODS
M. Fantozzi and B. Huber 1969 43 p refs
(EUR-4255.e) Avail: CFSTI

The code CRAYON G1 calculates the evolution of the following characteristics of a cylindrical gas-bonded fuel rod during irradiation: fuel temperature and swelling, fission gas release and pressure, and sheath stress and strain. The relations utilized in the code are exposed. For the ORGEL fuel element (SAP-clad uranium carbide), material properties, being input data for the code, are given. The constants concerning the irradiation behavior of uranium carbide were adjusted by application of the code to the irradiation experiment NRX-721. Author

N69-31237# Gulf General Atomic, San Diego, Calif.
FAST REACTOR SPECTRUM MEASUREMENTS Quarterly Progress Report, Period Ending 31 Oct. 1968
C. A. Preskitt, P. d'Oultremont, J. M. Neill, and J. C. Young 1 Nov. 1968 31 p refs
(Contract AT(04-3)-167)
(GA-9140) Avail: CFSTI

Experimental activities primarily concentrated on the loading and spectral measurements for assemblies STSF-3 and STSF-4. These assemblies were zoned versions of Assembly 6 of ZPR-6, a 4000-liter core, for which critical experiments were recently performed. This assembly of ZPR-6 had a critical mass of 1817 kg of ^{235}U and represents a typical composition for an oxide fueled LMFBR. Other experimental studies included: (1) a final calibration of the lithium glass detector used for many of the measurements, and (2) an in-core diaway measurement. Analytical work was performed in support of the loading operations for STSF-3 and -4 and calculations initiated for the analysis of data from these systems. Some effort was devoted to the formulation of a new data reduction code designed to improve the accuracy of corrections due to the finite diaway time of the systems studied. Author (NSA)

N69-31243# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
IMMEDIATE RELATION OF ING TO FAST BREEDER REACTOR PROGRAMS
W. Bennett Lewis Jan. 1969 23 p refs
(AECL-3251; DM-97) Avail: CFSTI; CAN $0.50

The use of fast neutron ING facilities in the development of liquid Na–cooled fast breeder reactors is described. The reactor facilities of DFR, EBR-2, and FFTF are described in terms of usefulness to the development of liquid Na-cooled fast breeder reactors. NSA

N69-31246# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
ESTIMATE OF POSSIBILITIES OF GAMMA-GAMMA RADIO CORE SAMPLING [APERCU SUR LES POSSIBILITIES DU RADIO CAROTTAGE GAMMA-GAMMA]
P. Dumesnil 21 Feb. 1968 17 p refs In FRENCH Presented at the Conf. on Display of Inform. for Foreign Engr., Razes, France, Feb. 1968
(CEA-CONF-1187; CONF-680213-1) Avail: AEC Depository Libraries

The principle of γ–γ density measurement is described, and a practical method for the determination of the energy threshold is given. The application of the method to uranium ores is discussed. The field studies made with the radio core sampling method are described. A precision of about 15% was deduced. NSA

N69-31256# Gulf General Atomic, San Diego, Calif.
POSSIBLE INSTABILITIES IN A THERMIONIC REACTOR WITH NEGATIVE REACTIVITY COEFFICIENTS
C. A. Heath 19 Sep. 1968 10 p Presented at the IEEE Thermionic Conversion Specialist Conf., Framingham, Mass.
(Contract AT(04-3)-167)
(GA-8943; CONF-681035-2) Avail: CFSTI

An analysis of stability in a thermionic reactor has been performed which includes the delayed collector and structure coefficients. This analysis shows that, for certain ranges of coefficients, it is possible for a thermionic reactor to show open-loop oscillatory instability with all negative coefficients. This phenomenon exists for small ($<6 \times 10^{-7}$/°K) negative values of the temperature coefficient of the emitter material. An increase in the magnitude of the negative coefficient of the collector and structure material does not improve the stability of the system and for some cases will lead to oscillatory instability. Proposed methods of increasing the negative coefficient of the emitter are discussed.
Author (NSA)

N69-31267# Gulf General Atomic, San Diego, Calif.
FAST CRITICAL EXPERIMENTS IN SUPPORT OF THERMIONIC REACTOR PHYSICS
S. C. Cohen, R. A. Moore, J. L. Russell, Jr., D. A. Sargis, and R. Sharp 26 Aug. 1968 22 p refs Presented at IEEE Thermionic Conversion Specialist Conf., Framingham, Mass. 26 Aug. 1968
(Contract AT(04-3)-167)
(GA-8767; CONF-681035-1) Avail: CFSTI

The objective of the thermionic critical experiment is to compare integral neutronic data from a series of critical assemblies with detailed neutronic calculations and to check analytical methods and cross section data used in the core design of thermionic space power reactors. An orderly progression of assemblies ranging from the very simple in composition and configuration to actual zero-power mockups of thermionic reactors is planned. The early experiments will feature bare, homogeneous assemblies which will provide clean integral data concerning the cross sections of thermionic materials. The integral data will be augmented by differential neutron spectrum measurements by the pulsed source, time-of-flight method. Assembly No. 1, a bare, neutronically homogeneous mixture of fully enriched uranium and polyethylene, was taken critical on May 10, 1968. The composition was chosen to provide a reasonably clean neutronic simulation of the neutron spectrum for a thermionic reactor core reflected with beryllium oxide. Measurements completed to date include critical mass, subcritical neutron spectrum, and central reactivity worths of thermionic reactor materials. The results of these initial experiments are compared with analysis. 12 references.
Author (NSA)

N69-31272# Atomic Energy Commission, Washington, D.C.
SELECTED BACKGROUND INFORMATION ON URANIUM ENRICHING
Mar. 1969 56 p refs
(ORO-668) Avail: US AEC Div. of Tech. Inform. Extension, P.O. Box 62, Oak Ridge, Tenn. 37830 at no cost

The seven separate steps of the nuclear fuel cycle (mining and milling, UF_6 conversion, enrichment, fabrication, irradiation, shipping, and reprocessing) are discussed. Typical cost experience for each step is included, with special emphasis placed on the enrichment step and its relation to the over-all fuel cycle. A description of gaseous diffusion plants is presented, including options and costs for increasing uranium enrichment capabilities. Current and long-term operational planning for optimization of power procurement, plant improvements, new plant additions, and level of preproduction are presented. Estimates are given of costs for operation of existing gaseous diffusion plants and capital investments for process improvements to the plants and construction of new plants.
NSA

N69-31278# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
CALCULATION OF REACTIVITY BY DIGITAL PROCESSING [CALCUL DE LA REACTIVITE PAR TRAITEMENT NUMERIQUE]
Jean Hedde Dec. 1968 172 p In FRENCH
(CEA-R-3691) Avail: AEC Depository Libraries

With a view to exploring the new possibilities offered by digital techniques, a description is given of the optimum theoretical conditions of a computation of the realtime reactivity using counting samples (obtained from a nuclear reactor). The degree to which these optimum conditions can be attained depends on the complexity of the processing which can be accepted. A compromise thus has to be made between the accuracy required and the simplicity of the equipment carrying out the processing. An example is given, using a relatively simple structure, which gives an accuracy of the results obtained over a wide range of the reactor power.
Author (NSA)

N69-31279# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
PROCESS FOR FINISH MACHINING REACTOR PRESSURE TUBES
J. G. Melvin, A. D. McEachern, and J. G. McManus Aug. 1967 30 p refs
(AECL-3252; CRNL-45) Avail: CFSTI; CAN $1.00

Significant burnup gains in a CANDU reactor would result from closer manufacturing control of pressure tube wall thickness. A finish machining process which removes wall thickness variations greater than ±0.0005 in. has been demonstrated. Ultrasonic scanning of thickness is applied to the control of an electrochemical machining (ECM) system.
Author (NSA)

N69-31285# Sandia Corp., Albuquerque, N.Mex.
AN EXPLOSIVE GENERATOR POWERED THETA-PINCH
R. A. Demerow, J. C. Crawford, C. M. Fowler (Los Alamos Sci. Lab.), R. S. Caird (Los Alamos Sci. Lab.), K. J. Ewing (Los Alamos Sci. Lab.) et al Feb. 1969 22 p refs Sponsored by AEC
(SC-RR-69-51) Avail: CFSTI

Explosively driven generators have been used to create neutron-producing plasma in conventional θ-pinch coils. The generators are two sizes of spiral-wound flux compression devices, loaded respectively with 5 and 17 pounds of high explosive, and are used with an exploding-wire high-voltage switch to produce θ currents of approximately 2.5 and 5 megamperes, respectively. In the experiments, the rise times varied from 1.6 to 4 μsec, and the θ-pinch coils were of lengths 25 and 35 cm. These currents produced fields from 106 to 224 kG in the θ coils. Five plasma shots were fired with the 2.5-megampere generator and four with the 5-megampere generator, each using a 40-kiloampere linear discharge preionizer, reverse fields of 1.7 to 3.5 kG, and 80 to 90 μ of deuterium in a preconditioned discharge tube. The highest neutron yields obtained were 7×10^5 for the 2.5-megampere case, and 1.4×10^8 for the 5-megampere generator.
Author (NSA)

N69-31297# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
SINBAD: A SPACE-INDEPENDENT NUCLIDE BUILDUP AND DEPLETION CODE
G. E. Putnam Jan. 1969 102 p refs
(Contract AT(10-1)-205)
(IDO-17217) Avail: CFSTI

Production and depletion by fission, capture, and radioactive decay processes are considered. For 32K computers, the code presently allows up to 250 nuclides, three sets of fission yields, and four daughters (branches) from a parent nuclide. About 0.03

second of IBM 7044 time is required per nuclide (for each time point computed) with the fairly complex schemes typical of fission products. The SINBAD code presently exists in Fortran IV and Fortran 63 versions. Author (NSA)

N69-31314# Union Carbide Corp., Oak Ridge, Tenn. Criticality Data Center.
SOME EFFECTS OF INTERSPERSED MODERATION ON ARRAY CRITICALITY
J. T. Thomas. 14 Mar. 1969 24 p refs
(Contract W-7405-eng-26)
(X-CDC-6) Avail: CFSTI

Monte Carlo calculations have been made of experimental reflected critical arrays of U(93.2) metal cylinders exploring the effect on criticality of introducing hydrogenous and nonhydrogenous materials as moderators both separately and in combinations. It was determined that as little as 0.32 cm of steel surrounding the individual units of a reflected array is sufficient to maintain subcriticality independent of the amount and distribution of interspersed hydrogenous moderator present. Some benefits to nuclear safety specifications for storage and transport of fissile materials are suggested, and an example of nuclear safety evaluation provided by these analyses is presented. Author (NSA)

N69-31317# Oak Ridge National Lab., Tenn.
TECHNIQUES AND APPARATUS FOR INSPECTION, HANDLING, AND ANNEALING HIGHLY RADIOACTIVE FUEL MICROSPHERES
M. T. Morgan and R. L. Towns. Mar. 1969 32 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2495) Avail: CFSTI

Techniques and equipment have been developed for remote handling, inspecting, and annealing of coated nuclear fuel microspheres. The equipment is adapted for use in shielded glove boxes and includes a revolving microprobe stage with vibrator to turn particles over remotely, a suction pickup, wrist action manipulators, a Geiger-Mueller tube probe, and induction type annealing furnace, and a separate gas collection and analysis system. Author (NSA)

N69-31319# Junta de Energia Nuclear, Madrid (Spain). Division de Materiales.
DISSOLUTION OF NUCLEAR FUELS
A. Uriarte Hueda, M. Berberana Eizmendi, and R. H. Rainey. 1968 27 p refs In SPANISH
(JEN-201-DMa/I-22) Avail: AEC Depository Libraries

A laboratory study was made of the instantaneous dissolution rate for unirradiated uranium metal rods and UO_2, PuO_2, and PuO_2–UO_2 pellets in boiling nitric acid alone and with additives. The uranium metal and UO_2 dissolved readily in nitric acid alone; PuO_2 dissolved slowly even with the addition of fluoride; PuO_2–UO_2 pellets containing as much as 35% PuO_2 in UO_2 gave values of instantaneous dissolution rate to indicate that they can be dissolved with nitric acid alone. An equation to calculate the time for complete dissolution was determined as a function of the instantaneous dissolution rates. The calculated values agree with the experimental values. Uranium dioxide pellets from various sources but with the same density varied in instantaneous dissolution rate. All the pellets, however, dissolved in the same time. Author (NSA)

N69-31456# Central Electricity Generating Board, Berkeley (England). Berkeley Nuclear Labs.
FRIC: A MULTIGROUP POINT MODEL OF THE FAST REACTOR
R. H. Clarke. Jan. 1969 28 p refs
(RD/B/N-1304) Avail: AEC Depository Libraries

FRIC is a FORTRAN IV program written for the IBM 360/75 to solve the multigroup diffusion equations at a point, using a standard UKAEA 35 group fast reactor library. The multiplier can be put on a variety of terms so that buckling, fission source, material composition and prompt neutron decay searches are available. The program will provide condensed cell-averaged data, either using the eigenvector calculated, or over a spectrum read in. In addition these data can be punched out in the form required by CRAM. The fractional breeding gain and the reactivity contribution of each group are printed out with the breeding gain of the cell as a whole. Author (NSA)

N69-31468# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Siebersdorf. Institut fuer Reaktortechnik.
SOME PROBLEMS IN THE NUMERICAL CALCULATION OF REACTORS [UBER EINIGE PROBLEME DER NUMERISCHEN BERECHNUNG VON REAKTOREN]
P. Nathschlaeger, F. Pntz, and J. Wagner. Oct. 1968 8 p refs In AUSTRIAN
(SGAE-RT-21/1969) Avail: CFSTI

The problems discussed here are those encountered in calculating the time-space development of nuclear, thermodynamic, and hydraulic processes in the reactor. Limitations, complexities, and accuracy of solutions are briefly pointed out and discussed in the applications of the Boltzmann transport equation, the group diffusion equations, weighting functions, variational principles, and the functional analysis of processes in reactor physics and engineering. Transl. by K.W.

N69-31478# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
REACTIVITY ACCIDENT TEST RESULTS AND ANALYSES FOR THE SPERT 3 E-CORE: A SMALL, OXIDE-FUELED, PRESSURIZED-WATER REACTOR
R. K. McCardell, D. I. Herborn, and J. E. Houghtaling. Mar. 1969 185 p refs
(Contract AT(10-1)-205)
(IDO-17281) Avail: CFSTI

A program of reactivity accident tests has been performed with the Spert III E-core—a small, oxide-fueled, pressurized-water reactor (PWR), which except for size is generally characteristic of an unborated, commercial PWR with essentially no fission product inventory in the core. With this core, 80 nondamaging power excursions were initiated from typical PWR operating conditions, viz, cold-startup, hot-startup, hot-standby, and operating-power initial conditions. The excursions resulted from rapid reactivity insertions ranging from 0.5 to 1.3$. The data obtained provide the only known experimental reactivity accident results for low-enriched oxide cores at initial conditions other than cold-startup. The cold-startup power excursions were essentially limited by Doppler broadening of ^{238}U resonance absorption cross sections, which provided the majority of the total reactivity compensation. Author (NSA)

N69-31500*# Techtran Corp., Glen Burnie, Md.
SOME CONSIDERATION OF SAFETY HANDLING OF X-RAY DIFFRACTION APPARATUS
Emiko Konishi et al. Washington NASA Jul. 1969 14 p refs Transl. into ENGLISH from Hoken Butsuri (Japan), v. 2, no. 2, 1967 p 57–66
(Contract NASw-1695)
(NASA-TT-F-12310) Avail: CFSTI CSCL 20H

Some practical considerations of safety handling of X-ray diffraction apparatus are presented. The following points are mentioned: (1) Most accidental hazards result either from mishandling or careless use. (2) Regulations are inadequate at present. (3) Interest in safety control is inadequate. Monitoring and survey techniques were investigated in detail, and it was suggested that

qualitative monitoring of leakage and scattered radiation is more important than quantitative dose rate measurements. It is shown that unnecessary radiation exposure of operators occurs mainly in the process of tube adjustment and sample positioning. Author

N69-31513# General Electric Co., Idaho Falls, Idaho. Missile and Space Div.

NUCLEAR TEST GAUGE Safety Analysis Report

G. J. Briscoe, J. H. Lofthouse, and R. B. O'Brien 21 Feb. 1969 67 p refs

(Contract AT(40-1)-2847)

(GEMP-663) Avail: CFSTI

The Nuclear Test Gauge (NTG) is a subcritical nuclear assembly, fueled with enriched uranium foils and moderated and reflected by Plexiglas, which is used to measure the relative nuclear characteristics of reactor materials. The NTG was constructed and operated for eight years at the Evendale, Ohio, plant which is operated for the AEC by General Electric Company, Nuclear Systems Programs. In 1966, it was shipped, fully fueled, to the GENSP Idaho Test Station where it is now set up for evaluation and use. Although the system is to be maintained in the subcritical condition, it is provided with essentially the same safeguards and is to be operated under the same administrative controls as are critical experiment reactors. Therefore, the probability of a nuclear excursion is very low. Nevertheless, a series of postulated nuclear transients have been analyzed. The radiological hazards associated with the worst of these are minimal, and it is concluded that the proposed operation of the NTG constitutes a negligible public risk. Author (NSA)

N69-31514# Oak Ridge National Lab., Tenn.

HFIRHY: A COMPUTER PROGRAM FOR CALCULATION OF FLOW DISTRIBUTION AND PRESSURE DROP IN THE HFIR CORE

L. A. Haack 14 Mar. 1969 17 p refs

(Contract W-7405-Eng-26)

(ORNL-TM-2541) Avail: CFSTI

A computer program, HFIRHY, has been written which calculates flow rates through the major parallel flow paths of the HFIR core and the pressure drop across the fuel element. The program is simply a computer version of the manual method outlined previously and adapted for use at HFIR. Written in FORTRAN IV for use on the online CDC-1700 computer, the program uses 16 inputs (most of which are pressure readings across either a venturi meter, or orifices, or between various parts of the reactor pressure vessel). The inputs are combined with appropriate flow-Δp correlations which were obtained out-of-pile during development of the various reactor components several years ago. At present, all readings are taken by an operator and later entered on a teletype for execution of the program. However, with modification to some of the instrumentation, the CDC-1700 could read all the necessary data (the computer already continuously monitors many of the reactor parameters required for the program) and then execute the program with no need to enter manually the required data. Author (NSA)

N69-31541# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.

SAVANNAH RIVER LABORATORY ISOTOPIC POWER AND HEAT SOURCES. PART 1: Co-60 Quarterly Progress Report, Oct.–Dec. 1968

H. S. Hilborn comp. Feb. 1969 19 p refs

(Contract AT(07-2)-1)

(DP-1192-1) Avail: CFSTI

Preliminary (theoretical) analyses indicated that CoO and CoO-MgO solid solutions are promising high temperature fuel forms of ^{60}Co. Extrapolation of stress-rupture data from the literature indicated that superalloy capsules will perform satisfactorily for 5 years at 1000°C or higher. Haynes 25 had the highest long-term strength of the materials tested. Satisfactory performance of an inactive Inconel 600 capsule at 1000°C for 10,000 hr (1.14 yr) was confirmed by destructive examination. More internal reaction than expected was revealed by destructive examination of two active capsules after 10,000 hr at 900°C. Author (NSA)

N69-31542# Kernforschungszentrum, Karlsruhe. (West Germany). Inst. fuer Angewandte Reaktorphysik.

THEORETICAL AND COMPUTER ANALYSIS ON THE BEHAVIOR OF FAST REACTOR FUEL PINS AND RELATED PARTS OF THE CORE UNDER OPERATIONAL CONDITIONS

G. Karsten, H. Kaemph, and A. Gerken Nov. 1968 48 p refs

(KFK-878; EURFNR-610; EUR-4158d.e) Avail: AEC Depository Libraries

A study of the maximum operation times of fuel pins was made by following the reference design study on the Sodium Cooled Fast Breeder Reactor Na-2. As the basis of this examination there was taken a defined three zone volume balance relating to the swelling of fuel volume and the consumption of void volume, given by the hot gap volume, the axial expansion and ratios of the pore volume. To calculate the maximum burnup with this model the radial temperature distribution had to be treated quantitatively. A new porosity relationship of the thermal conductivity was used. A two zone porosity model was applied for the characterization of the porosity migration in the plastic region connected with the central channel formation and a densification in the plastic region. The used zone swelling rates and applied availability factors were argued. The still unsolved fuel clad interaction problem was characterized and discussed. Author (NSA)

N69-31565# California Univ., Berkeley. Lawrence Radiation Lab.

SOME ac LOSS DETERMINATIONS BY AN ELECTRICAL MULTIPLIER METHOD

W. S. Gilbert Jul. 1968 5 p

(Contract W-7405-eng-48)

(UCRL-18755; Conf-680621-16) Avail: CFSTI

The cyclic losses in a superconducting magnet were measured with the electrical multiplier method employing Hall effect multipliers. The magnet was a solenoid 4.5 in. long with a 1.5-in. bore and a 4.5-in. OD wound with a single-core NbTi Supercon wire. The wire core size was 15 mils and conductor was 30 mils overall, giving a copper-to-super conductor ratio of 3:1. It was found that: current density in NbTi systems, above 50,000 A/cm^2, are readily achievable if the fraction of stabilizing material can be reduced; losses small enough to make pulsed accelerators attractive have not yet been demonstrated; and a multicore conductor with large (15 mil) cores is degraded when wound into magnets because of flux jumps. NSA

N69-31570# Argonne National Lab., Ill.

OPTIMAL DIGITAL COMPUTER CONTROL OF NUCLEAR REACTORS

Walter C. Lipinski (Ph.D. Thesis–Ill. Inst. of Tech., Chicago) Jan. 1969 255 p refs

(Contract W-31-109-eng-38)

(ANL-7530) Avail: CFSTI

Research undertaken with the objective of applying modern control theory to the analysis and design of an optimal control system for reactors is described. The optimal regulator control law is determined, and the states of the nonlinear deterministic system model are estimated. A consequence of applying dynamic programming to obtain the feedback regulator solution and iteration to the estimation problem is the requirement that a digital computer

be used to implement the control and estimation functions. A comprehensive literature survey of earlier applications of modern control theory to nuclear reactors, a detailed review of pertinent reactor kinetics equations, and a compilation of selected nuclear and control engineering bibliographies are included. NSA

N69-31617# Oak Ridge National Lab., Tenn.
SPRAY AND POOL ABSORPTION TECHNOLOGY PROGRAM
T. H. Row Apr. 1969 32 p refs
(Contract W-7405-Eng-26)
(ORNL-4360) Avail: CFSTI

There has been a significant increase in the number of nuclear power plants under construction or scheduled in the past two years. The requirements for additional sites have dictated that reliable engineered safeguards be proven. The present plant designs include containment building spray systems for pressurized-water reactors and pressure-suppression pools for boiling-water reactors. A search for solutions exhibiting a high removal rate for molecular and organic iodine is described. The best solutions from this search are used in single-drop wind-tunnel experiments to determine the removal characteristics more accurately. The additives most applicable to industrial uses are then applied in engineering-scale tests, in addition to corrosion and thermal and radiation stability tests. Author (NSA)

N69-31645# Oak Ridge National Lab., Tenn. Chemical Development Section B.
HEAD-END STUDIES OF Si C-COATED HTGR FUELS: UNIRRADIATED DRAGON COMPACT NO. 8232
V. C. A. Vaughen Feb. 1969 33 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-2389) Avail: CFSTI

The first unirradiated Dragon fuel compact was crushed, sieved, and subdivided into replicate portions to test for the fraction of silicon carbide-coated beads broken in handling and heavy-metal recoveries and losses in the crush-grind-leach flowsheet and in the crush-burn-grind-leach flowsheet. Standardized experimental techniques were devised for these tests. Both process flowsheets gave greater than 99.9% recoveries of heavy metals. Author (NSA)

N69-31655# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Reaktorentwicklung.
FAST REACTOR CORE HEAT REMOVAL
D. Smidt Nov. 1968 38 p refs
(EURFNR-815; KFK-883; EUR-4162) Avail: AEC Depository Libraries

The problem of optimizing fast reactor design parameters while maintaining sufficient core cooling potentials is analyzed. The reactor model discussed has a core of multiple parallel metal clad rods filled with PuO_2–UO_2. Coolant possibilities which are analyzed include: gas, steam; and liquid Na. NSA

N69-31674# Oak Ridge National Lab., Tenn.
HIGH FLUX ISOTOPE REACTOR Quarterly Report, Oct.–Dec. 1968
R. V. McCord and B. L. Corbett Apr. 1969 42 p refs
(Contract W-7405-Eng-26)
(ORNL-TM-2527) Avail: CFSTI

Operations and maintenance requirements performed for the HFIR during October to December 1968 are presented. Analysis of heat exchanger tube vibration damage and failure is included. NSA

N69-31712# Brookhaven National Lab., Upton, N.Y.
AUTOMATED DATA ACQUISITION AT THE HFBR
R. E. Chrien 28 Feb. 1969 16 p refs Presented at the Conf. on Computer Systems in Exptl. Nucl. Phys., Skytop, Pa., 2–7 Mar. 1969 Sponsored by AEC
(BNL-13428; Conf-690301-1) Avail: CFSTI

Test facilities at the Brookhaven High Flux Beam Reactor are described. Details of the multiple spectrometer control system which is used for automation of neutron experiments, are given. Use of on-line time-shared computers for direct processing of experimental data is discussed; operating experience with these time-shared computers is summarized. Application of the computer-spectrometer system to data acquisition for the various neutron physics studies is outlined. NSA

N69-31721# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
THE FAST NEUTRON CAVITY EXPERIMENT IN THE PCTR
D. F. Newman, C. L. Bennett, W. P. Stinson, and D. D. Lanning 26 Jun. 1968 47 p refs
(BNWL-CC-1704) Avail: CFSTI

A large fast neutron cavity (FNC) was constructed and loaded into the central test region of the Physical Constants Test Reactor (PCTR) for an initial experiment to determine the capabilities of the system. The initial experiments were designed to develop the techniques for further use of the FNC with fast reactor fuels and to study effects that may be of interest to future NPTF and FTR neutron energy distribution studies. The work carried out with the FNC was concerned with three main objectives: installation of the FNC and loading enriched uranium fuel in the thermal zone until criticality was achieved; carrying out the necessary safety tests on the reactor to insure compliance with the operating specifications and to gain operational experience; and experimentation with various measuring methods which are intended to be applied for subsequent measurements on fast reactor fuels inserted into the FNC. Author (NSA)

N69-31724# Gulf General Atomic, San Diego, Calif.
POSTIRRADIATION EXAMINATION OF PEACH BOTTOM FUEL ELEMENTS E05-05 AND C05-05, AND RELATED ANALYSIS
D. D. Busch, F. D. Carpenter, R. C. Dahlberg, B. F. Disselhorst, D. G. Guggisberg et al 17 Mar. 1969 137 p
(Contract AT(04-3)-314)
(GAMD-8743) Avail: CFSTI

Design parameters for Peach Bottom Power Reactor Unit 1 fuel elements are presented. Fabrication procedures for the fuel elements are described. Results of postirradiation examination of fuel elements E05-05 and C05-05 are presented. NSA

N69-31740# Gosudarstvennyi Komitet Po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
METHOD FOR DEFINING THE REGIME OF ACCELERATION IN THE INJECTOR OF THE ACCELERATOR OF THE IHEP [METODIKA OPREDELENIYA RASCHETNOGO REZHIMA USKORENIYA V INZHEKTORE PROTONNOGO INKHROTRONA IFVE]
A. G. Afonin, S. I. Il'euskii, I. M. Kapchinskii, L. M. Popinenkova, and V. A. Teplyakov 1968 21 p refs In RUSSIAN
(IFVE-INZH-68-49-K) Avail: AEC Depository Libraries

A method for defining the RF field levels and phases of the cavities is described for the 100-MeV proton linac I-100 as the injector of the accelerator of the IHEP. The zero current technique, which allowed to find the threshold of the RF field levels and phases is described. The choice of the buncher's regime and the experimental data of some parameters of the Linac I-100 are discussed. Author (NSA)

N69-31745# General Electric Co., San Jose, Calif. Nuclear Fuels Dept.
SPECIFIC ZIRCONIUM ALLOY DESIGN PROGRAM Quarterly Reports
A. S. Mehner, H. H. Klepfer, and A. E. Pickett Jan. 1969 30 p refs
(Contract AT(04-3)-189)
(GEAP-5743; QR-22; QR-23; EURAEC-2096) Avail: CFSTI

A Zr + 2.0 at. % Cr + 0.16 at. % Fe alloy (Zr-Cr) is being evaluated as nuclear fuel cladding. Zr-Cr alloy-clad fuel rods are being irradiated to a target exposure of 20,000 MWd/tU. The rate of fuel burnup has been approximately 800 MWd/tU per month of full-power operation. The long-term, out-of-pile, loop corrosion tests have been satisfactorily completed. The Zr-Cr samples were tested in a loop which simulated a boiling-water environment including heat transfer. The samples accumulated approximately 7,800 hours of exposure. During the June–July 1968 reactor outage, the pool examination of the B-1 assembly indicated that the Zr-Cr and Zr-2 test rods were performing satisfactorily after 8,000 MWd/tU bundle average exposure. Author (NSA)

N69-31785# Eidgenoessiches Institut fuer Reaktorforschung, Wuenlingen (Switzerland).
EXPERIMENTAL PHYSICS STUDIES ON DEUTERIUM OXIDE-MODERATED LATTICES OF NATURAL URANIUM DIOXIDE CLUSTERS WITH GAS AND WATER COOLANTS
W. Heer, P. Jost, R. Richmond, and B. Rueegger Dec. 1968 59 p refs
(EIR-143) Avail: AEC Depository Libraries

The results are presented of experimental physics measurements on a series of D_2O-moderated reactor lattices chosen to extend the existing range of information on lattices of this type. The quantities measured were the material buckling, the neutron density fine structure, and the ratio of ^{238}U neutron capture to ^{63}Cu neutron capture in the fuel cluster. The experimental results have been compared, in the first instance, with the predictions of the assessment code METHUSELAH II and it has been shown that this code continues to achieve its aim of providing an assessment tool giving on accuray of 1 to 2% in reactivity predictions. NSA

N69-31792# Argonne National Lab., Ill.
APPLICATION OF THE COLLISION THEORY FOR THE CALCULATION OF REACTIVITY VALUES [ANWENDUNG DER STROSSTHEORIE ZUR BERECHNUNG VON REAKTIVITAETSWERTEN]
A. E. Fischer Jan. 1969 12 p Transl. into ENGLISH of IAR-SNEAK 1, Notiz 147 (Leopoldshafen), 20 Mar. 1968 p 1–15
(ANL-Trans-716) Avail: CFSTI

Reactivity worth measurements on samples in critical assemblies are usually interpreted under conventional perturbation theory assumptions. Presented is a more exact transport theory analysis of reactivity values, in which the spatial interaction of the resonance flux and self shielding effects of the sample are considered. NSA

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N69-30433 Stanford Univ., Calif.
MAGNETIC DOMAIN WALLS OF THE ORTHOFERRITES
Arjeh Jehuda Kurtzig (Ph.D. Thesis) 1968 131 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 68-247

A new technique for the direct measurement of the domain wall energy per unit area has been developed and applied in the orthoferrites; a second new technique is proposed; and a third previously reported technique has been reinterpreted and improved. Domain walls in the orthoferrites have been controlled by eight techniques to form five different simple configurations. One of these simple configurations consists of planar, parallel, equally spaced domain walls. A second simple wall configuration consists of a single planar domain wall that bisects a sample. The planar wall can be controllably stretched into an S shape by an applied magnetic field. Calculation of the domain wall energy per unit area from this controlled wall stretch is possible. Dissert. Abstr.

N69-30594 Northwestern Univ., Evanston, Ill.
A STUDY OF INDIRECT IMPURITY INTERACTIONS IN DILUTE MAGNETIC ALLOYS AT LOW TEMPERATURES
Raymond Herbert Bresemann (Ph.D. Thesis) 1968 138 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-1802

The indirect interaction between two impurity spins in a dilute magnetic alloy is studied in the temperature region where the Kondo effect is operative, using an extension of the Nagaoka approach involving thermodynamic Green's functions. The objective is to calculate the average energy of the system using the Kondo Hamiltonian, which consists of the kinetic energy of the conduction electron sea and the s-d exchange interaction. The basic Green's function equations of motion are utilized to solve for those Green's functions relevant to the calculation of the average energy. In particular, a separation technique is employed on the Green's functions so that interaction terms of the Heisenberg form between impurities may be isolated. A decoupling of the higher order Green's functions inherent to the equations of motion is then performed which allows the set of equations of motion to be closed and solved. Dissert. Abstr.

N69-30615 Kansas State Univ., Manhattan.
GENERATION OF LIGHT BY THE RELATIVE MOTION OF MERCURY-GLASS CONTACTS
Gay Leon Dybwad (Ph.D. Thesis) 1968 196 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 68-17503

Glass was found to become negatively charged when liquid mercury was placed in contact with it. The electrons reside in surface traps and remain there when the mercury departs from the glass due to the mechanical rotation of the ball. The electrons return to the mercury pool via a gas path, and three different types of light emitting discharges can be distinguished: (1) High field discharge is a low intensity pulse discharge which depletes the original charge density when the mercury and glass have just separated. (2) In continuous or Townsend discharge, much of the emitted radiation is due to a low current, continuously occurring Townsend discharge between loosely bound surface electrons on the glass and the mercury pool. (3) In pulsed or glow discharge, when deeply bound electrons are found on the glass surface, they can be released in a burst from a glow discharge which results in a brief but energetic pulse of radiation. Dissert. Abstr.

N69-30630 Clarkson Coll. of Technology, Potsdam, N.Y.
TWO SPIN CLUSTER MODEL FOR YIG
Denis F. Strenzwilk (Ph.D. Thesis) 1968 85 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-17954

An effective field theory called the Oguchi method was used to describe the magnetization of the yttrium iron garnet. The main feature of the modal is that it includes spin correlation through a two spin cluster. The theoretical magnetization was fitted by the method of least squares to the experimental data. Two calculations were performed. Dissert. Abstr.

N69-30762# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
STELLARATOR-TYPE CONFIGURATION WITH MEDIUM WELLS AND SHEARING OF MAGNETIC LINES [CONFIGURATIONS DU TYPE STELLARATOR AVEC PUITS MOYEN ET CISAILLEMENT DE LIGNES MAGNETIQUES]
C. Gourdon, D. Marty, E. K. Maschke, and J. P. Dumont (Soc. d'Etudes Tech. et d'Enterprises Gen., Le Plessiss-Robinson, France) [1968] 15 p refs In FRENCH Presented at 3rd Intern. Conf. on Controlled and Plasma Phys., Novosibirsk, USSR, 1 Aug. 1968
(CEA-CONF-1003; CN-24/F-2; CONF-680805-28) Avail: AEC Depository Libraries

Recent theoretical studies on toroidal magnetic configurations of the stellarator type have shown a serious limitation of the maximum rotational transformation angle. A systematic study was made of those configurations proposed that permit simultaneously a median magnetic well and a shearing of the lines of force. A complete analysis of the configurations of different multipolar orders made it possible to distinguish a new class of configurations called "torsatron." A study was made of the effect of perturbations on the magnetic surfaces. The individual confinement of the particles was also considered. The study was done by numerical integration of the magnetic lines and the particle trajectories. The magnetic field was calculated from the conductor data. NSA

N69-30874 Oregon Univ., Eugene.
FARADAY ROTATION STUDIES OF AN R-LIKE CENTER IN NEUTRON IRRADIATED MgO
James Alexander Glaze (Ph.D. Thesis) 1968 99 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-18

In this work the technique of optical Faraday rotation has been used to study the lines at 5233 Å and 6419 Å which correspond to E - - A and E - - A transitions respectively. It is shown, by examination of temperature and magnetic field variations in the Faraday rotation spectrum, that the line at 5233 Å is associated with a paramagnetic center. This rotation is shown to vary as $1/T$ in the range 1.81°K to 4.22°K for fields less than 10 kG. The field dependence is linear up to 40 kG. at 4.2°K but at 1.81°K it shows strong saturation behavior from 10 kG. to 55 kG. The resulting saturation curve can be fitted to tanh (gβH/2kT) for a g value near 2. Since a g value of 2 implies that the center possesses an unpaired electron whose spin is essentially decoupled from its orbital motion, it is apparent that the orbital angular momentum associated with the E ground state is quenched. Dissert. Abstr.

N69-30902 Minnesota Univ., Minneapolis.
THE INTERACTION BETWEEN SMALL WATER DROPLETS AND THEIR LIQUID-VAPOR PHASE CHANGES IN STRONG ELECTRIC FIELDS
Frances Jean Anderson (Ph.D. Thesis) 1968 181 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 68-17656

The research consisted of studies of the interactions between small water droplets and their vapor in the presence of large electric fields, and interactions between the droplets and the electric fields. The droplets, in a size range 0.8 to 2 microns, were produced by expansion of saturated air which was pumped into the chamber. Behavior of the droplets with time was observed by noting the change in light intensity due to scattering and absorption by the droplets of a light beam transmitted through the chamber. Measurements of the transmitted light were combined with estimates of the water condensed from the air by the expansion to form droplets permitting the calculation of the average droplet radius and concentration. Direct observations of the droplet's behavior were also made to clarify the physical processes caused by the presence of the field. The properties of condensation nuclei produced by discharge from a metal point were also studied.
Dissert. Abstr.

N69-30933 Stevens Inst. of Tech., Hoboken, N.J.
CROSS-FIELD PLASMA TRANSPORT IN A MAGNETICALLY CONFINED LOW-BETA COLLISION DOMINATED PLASMA
George Eugene Courville (Ph.D. Thesis) 1968 145 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-16208

Measurements of plasma loss transverse to a uniform magnetic field have been made with a potassium Q-Machine for the parameter range $2050 < T < 2350°K$, $10^{10} < n < 10^{11} cm^{-3}$ and $1000 < B < 4000$ gauss. Plasma losses have been attributed to two mechanisms: M I, and E x B radial drift due to azimuthal temperature gradients at the hot ionizer plate, and M II, a wave-driven loss that has been identified as being due to a collisional drift-wave instability. Losses associated with M I can be expressed in terms of parameters by the empirical relation $\Gamma_1 = 3.8 \times 10^{5} \nabla n/B^2$ cm^{-2} sec^{-1}, where ∇n is the density gradient (in cm^{-4}) and B is the magnetic field (in gauss). The wave-driven loss rate has been correlated with oscillations through observation of simultaneous abrupt changes in oscillation mode, as predicted by drift wave theory, and in loss rate. The loss rate has been found to vary as the square of the rms signal amplitude recorded by a floating Langmuir probe. Dissert. Abstr.

N69-31000# Pennsylvania State Univ., University Park. Dept. of Physics.
STIMULATED SCATTERING IN LIQUIDS AND GASES Technical Report, 1 Jan. 1967–28 Feb. 1969
D. H. Rank, T. A. Wiggins, D. R. Dietz, N. D. Foltz, and C. W. Cho Feb. 1969 78 p refs
(Contract Nonr-656(12))
(AD-684880) Avail: CFSTI CSCL 20/6

A series of six papers on stimulated scattering is presented. A summary of the work on stimulated Rayleigh scattering in liquids is included. Polarization conditions are discussed and orientational relaxation times are determined. The existence of stimulated thermal Rayleigh scattering in gases and liquids has been observed. The threshold, critical absorption coefficient needed to suppress the stimulated Brillouin scattering, and the predicted anti-Stokes shift have been observed. The density dependence of the threshold has been investigated for CH4 and CO2. The time for thermalization of excited molecules when reduced to one atmosphere has been determined to be on the order of 0.1 microseconds. Author (TAB)

N69-31077*# IIT Research Inst., Chicago, Ill.
STUDY OF PASSIVE OPTICAL TECHNIQUES FOR DETECTING CLEAR AIR TURBULENCE
A. J. Montgomery and A. Weigandt [1968] 133 p refs
(Contract NAS12-116)
(NASA-CR-86161) Avail: CFSTI CSCL 20F

Passive optical techniques for advanced detection and information to the pilot on direction, distance, size, and shape of Clear Air Turbulences (CAT) were studied. The techniques included: (1) detection of spatial nonuniformities in scattered sunlight; (2) relative movement of stellar images; (3) stellar scintillation; (4) detection of thermal emission to determine temperature variations

gradients, and ozone concentrations; and (5) a schlieren-type system using the earth's horizon as a source. Refractive index, temperature, and density fluctuations associated with CAT were estimated based on available information and by calculations. Two techniques, detection of non-uniformities in scattered sunlight and stellar scintillation, are promising for CAT detection. Although these techniques may provide limited angular size and direction information, the capability to provide useful range information is still questionable. These two approaches were included in a proposed airborne program of CAT investigation. Author

N69-31185# California Univ., Berkeley. Lawrence Radiation Lab.
PHYSICS SEMIANNUAL REPORT, MAY–OCTOBER 1968
Nov. 1968 181 p refs Sponsored by AEC
(UCRL-18619) Avail: CFSTI

A report on research on experimental and theoretical high-energy physics at the Lawrence Radiation Laboratory is given. Also health physics, mathematics and computing, and the operation and development of accelerators are covered. NSA

N69-31190*# Kansas Univ., Lawrence. Engineering Science Div.
THE OMNIDIRECTIONAL SCATTERING OF ACOUSTIC WAVES FROM ROUGH SURFACES WITH APPLICATION TO ELECTROMAGNETIC SCATTERING
Bowen E. Parkins [1968] 170 p refs
(Contract NSR-17-004-003; Grants NsG-298; NSF GP-2259)
(NASA-CR-101797; CRES-48-4) Avail: CFSTI CSCL 20A

This work is a study of the scattering of acoustic waves from randomly rough surfaces and the extent of the similarity to the analogous electromagnetic problem. A theory is developed using the method of physical optics for the scattering of acoustic waves from randomly rough surfaces which are imperfectly reflecting yet homogeneous with respect to material parameters. This development is made for a surface which is given by a stationary, ergodic process with a Gaussian distribution of surface heights. The expression for the far zone acoustic power density is derived and the separation into scattered and reflected power components is made. The comparison of theory with experiment is favorable, and the theory is concluded to be a valid one. The similarity between acoustic and electromagnetic re-radiation from surfaces is investigated by comparing analogous expressions for the re-radiated fields. The expressions for the electromagnetic field are derived using the method of physical optics as are the acoustic expressions, and the determination is valid only for surfaces to which this method applies. Similarities are found to exist and there are cases where an exact acoustic simulation can be made. Author

N69-31211# Joint Publications Research Service, Washington, D.C.
TRANSLATIONS ON EASTERN EUROPE: SCIENTIFIC AFFAIRS NO. 57. Summary Report Made on Basic Research in Physics
Emil Dzhakov 20 Jun. 1969 53 p Transl. into ENGLISH from Spisanie Bulgar. Akad. Nauk. (Sophia), v. 14, no. 1, Mar. 1969 p 8-16
(JPRS-48271) Avail: CFSTI

The status of Bulgarian research and its future direction in the areas of solid state physics, nuclear physics, and radio physics and physical electronics are briefly reported. The fundamental principles of each of these disciplines are defined, followed by the specific aspects which are under investigation. The objective of the review is to present the prospects for the development of basic physics, its technological effects, and its relationship with other related physical and life sciences on an international scale, as compared with the directives for study in Bulgaria. A.C.R.

N69-31220# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
A TECHNIQUE FOR COMPUTING APPROXIMATE ELECTROMAGNETIC IMPULSE RESPONSE OF CONDUCTING BODIES
C. Leonard Bennett, Jr. and Walter L. Weeks Jun. 1968 152 p refs
(Grant NSF GK-2367)
(TR-EE68-11) Avail: Issuing Activity

A numerical technique for the time domain solution of scattering by perfect conductors is described. Scattering by parallel cylindrical conductors with arbitrary cross sections is considered for arbitrary angles of incidence. This technique is demonstrated by using it to calculate the approximate impulse responses of a circular cylinder for a normally incident wave and of a strip and a corner reflector. Scattering by three dimensional conducting bodies of arbitrary shape is also considered. The technique is used to compute the approximate impulse responses of a sphere and of a hemispherical capped cylinder with axial incidence. The application of the approximate electromagnetic impulse response is illustrated by using it to compute the frequency response of the bodies considered. In addition some close relationships between the approximate impulse response and the scatterer geometry are pointed out. Author

N69-31315# Temple Univ., Philadelphia, Pa. Dept. of Physics.
STRIATIONS IN EWP
Herbert Goronkin (Ph.D. Thesis) 31 Oct. 1968 19 p refs
(Contract F19628-67-C-0250)
(AD-685170; SR-2; AFCRL-68-0671) Avail: CFSTI CSCL 19/1

Striations in exploding wires have been examined in sequential frame studies to investigate the possibility that gas discharge type striations are formed in the electron-vapor sheath. These electrical striations, due to localized space charge formed by impact, move in the direction of majority electric current carrier motion. Explosions were carried out on samples immersed in distilled water in order to impede outgassing which could mask striations. No. 28 copper wire samples in 1 and 2 cm lengths were connected across a 45 microfarad capacitor bank charged to 3 to 8 kV. Within the range of electric fields used in this experiment, no movement of striations were observed. Comparison of striations in annealed and unannealed wires show that it is not likely that low velocity striations are present. The existence of mechanical striations has been firmly established. Author (TAB)

N69-31350*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
CAVITATION IN LIQUID CRYOGENS
D. K. Edmonds and J. Hord 1968 27 p refs Presented at the Cryog. Eng. Conf., Cleveland, 19–21 Aug. 1968
(NASA Order C-35560-A)
(NASA-CR-103288; H-4) Avail: CFSTI CSCL 20L

Cavitation characteristics of liquid hydrogen and liquid nitrogen flowing in a transparent plastic venturi were determined and conventional cavitation-inception-parameter curves are given. Representative developed-cavitation data, consisting of pressure and temperature measurements within fully-developed cavities, are also given; measured temperatures and pressures within the cavities were generally not in thermodynamic equilibrium. Existing theory was used to obtain equations which correlate the experimental data for developed cavities in liquid hydrogen or liquid nitrogen. The theory is extended to include the effect of cavity thickness, and the experimental data are used to evaluate the results. Author

N69-31477# Sandia Corp., Albuquerque, N.Mex.
LONG-RANGE AIRBLAST: PROJECT PALANQUIN
Jack W. Reed 25 Apr. 1969 44 p refs
(PNE-903-F) Avail: CFSTI

Eight microbarograph stations measured the airborne acoustic wave from Palanquin. By use of the high-explosive calibration shots fired close in time and space to the nuclear cratering event, the airblast transmissivity for this underground burst was determined to be 0.026. Rocket and rawinsonde upper air observations were used to calculate acoustic wave paths, times, and propagated amplitudes for comparison with observations. Some problems in correlation were encountered which could not be completely resolved, but a good general exercise in verification was allowed. Author (NSA)

N69-31488# Harry Diamond Labs., Washington, D.C.
A METHOD OF DETERMINING THE RESPONSIVE AREAS OF OPTICAL DETECTORS
Donald J. Mary Mar. 1969 17 p
(AD-686279; HDL-TM-69-6) Avail: CFSTI CSCL 20/6

A method of quickly determining the configuration of the responsive areas of optical detectors is described. Synchronized rasters are generated on two oscilloscopes. The screen of one oscilloscope is imaged by a lens onto the plane of the detector, whose electrical output varies as the scan progresses across the sensitive surface. The detector signal is amplified and used to intensity modulate the beam of the other oscilloscope. Thus, a picture of the detectors spatial response is generated. Photographs of three sample detectors are presented. A brief discussion of some of the optical and electrical factors affecting the results are included. Author (TAB)

N69-31498# Utah State Univ., Logan. Electro-Dynamics Labs.
AN OPTIMUM SYSTEM SYNTHESIS FOR OPTICAL RADIOMETRIC MEASUREMENT
Clair L. Wyatt, Doran J. Baker, and Alvin M. Despain 1 Jun. 1968 80 p refs
(Contract F19628-67-C-0322)
(AD-686112; SR-1; AFCRL-68-0329) Avail: CFSTI CSCL 20/6

The minimum detectable signal of an optical radiometer was optimized as a function of modulation and correlation waveforms, and relative amplitudes of source, reference, and noise levels. The mathematical model considers the radiometer as a device to estimate the variance of a Gaussian random process with zero mean. It was found that the optimum system is one which looks at the source for one half of the period and then abruptly switches to the reference for the remainder of the period. The theoretical results for three commonly encountered waveforms were computed and laboratory measurements confirm the results that were interpreted in terms of the detector parameter NEP. These are: (1) The optimum radiometer as described above for which the minimum detectable signal is Pm = 2 NEP. (2) The sine wave radiometer, which utilizes a tuned ac amplifier to select the fundamental sine wave component of the modulated signal for which Pm = 2.46 NEP. (3) The radiometer which produces a triangular wave resulting from the convolution of a chopper blade with an aperture of the same width for which Pm = 4 NEP. Author (TAB)

N69-31644# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
VISUAL SEARCH AND DETECTION UNDER SIMULATED FLARELIGHT. PART 2: EVALUATION OF A 5,000,000 CANDLEPOWER (cp) SOURCE Final Report
Robert L. Hilgendorf Jan. 1969 16 p refs
(AD-686424; AMRL-TR-68-112(2)) Avail: CFSTI CSCL 19/1

Preliminary laboratory research on methods for evaluating aerial flare sources and for optimizing their placement are described. Ten subjects performed target acquisition (detection and recognition) tasks under simulated Mark 24 flarelight (2,000,000 candlepower), and ten under simulated Briteye flarelight conditions (5,000,000 candlepower). Author (TAB)

N69-31678# California Univ., Livermore. Lawrence Radiation Lab.
AN ON-OFF LIQUID HELIUM CRYOPUMP
Balwant S. Denhoy and Thomas H. Batzer 1 Apr. 1969 9 p ref Presented at Symp. on Eng. Probl. of Fusion Res., Los Alamos, N.Mex., 8–11 Apr. 1969 Sponsored by AEC
(UCRL-71514; CONF-690407-8) Avail: CFSTI

An on–off thermal switch for thermally isolating the liquid He storage from the pumping surface is incorporated into a cryopump, which results in an increased pumping rate and efficiency as well as less hazardous operating procedures. The switch is a hermetic volume between the LHe storage and the pumping surface. Gas is introduced into the insulating space to establish thermal contact between the LHe and the pumping surface; then the gas is evacuated to thermally isolate the pumping surface. Author (NSA)

N69-31759# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Electrophysics.
NONLINEAR INTERACTION EFFECTS IN SOLIDS Final Report, 1 Dec. 1967–30 Nov. 1968
Arthur A. Oliner 17 Dec. 1968 28 p refs
(Contract F19628-68-C-0075)
(AD-685169; PIBEP-68-022; AFCRL-68-0655) Avail: CFSTI CSCL 20/6

The report is concerned with nonlinear interaction effects in solids, particularly those related to microwave acoustics and nonlinear optics. The studies themselves are basic in character, with emphasis on thorough treatments; the motivation for the topics chosen has in all cases been their importance and usefulness in various applications. Among the topics treated in detail are: the scattering of bounded laser beams by acoustically-modulated media, radiation from sources in acoustically-modulated media, parametric amplification and oscillation in bounded dielectric slabs, traveling-wave photoelastic parametric amplification, magnetoelastic parametric interactions, and methods of exciting Rayleigh surface acoustic waves on piezoelectric crystals. Author (TAB)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N69-30420 North Carolina Univ., Chapel Hill.
MANY-BODY EFFECTS IN POSITRON ANNIHILATION IN METALS
Soo Myung Kim (Ph.D. Thesis) 1968 140 p
Avail: Univ. Microfilms: HC $6.60/Microfilms $3.00 Order No. 69-1629

The angular correlation of photons from positrons annihilating in lithium, sodium, potassium, rubidium, and calcium was measured over a wide range of temperatures to obtain information about the many-body correlation effects on positron annihilation. Data were analyzed to yield the momentum dependence of the enhancement factor, positron effective mass and minimum effective temperature in these metals. The annihilation rate of positrons was found to be momentum dependent and this momentum dependence of the enhancement factor increased with r_s, the radius of the one electron sphere. The numerical values of the coefficients of the enhancement factor determined in these metals were found to be in close agreement with the many-body calculations by Kahana and co-workers. Theoretical one-electron calculations were shown to be inadequate in predicting the observed momentum dependence of the annihilation rate. Dissert. Abstr.

N69-30422 North Carolina Univ., Chapel Hill.
INTERNAL FRICTION STUDY OF VACANCY FORMATION AND DISLOCATION PINNING IN SILVER CHLORIDE
Jin Soon Kim (Ph.D. Thesis) 1968 138 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-1628

Dislocation pinning and vacancy formation in AgCl were studied by internal friction measurements, using a 35 kc Marx composite oscillator at its fundamental frequency in the longitudinal mode. The decrement of the specimen was measured as a function of temperature between 25° to 350°C. When the amplitude-dependent decrement was plotted against temperature, a broad peak occurred, the temperature of the peak increasing with increasing divalent impurity content of the specimen. This was explained in terms of electrical charge on dislocations in ionic crystals. The observed peak temperature was assigned to the extrinsic isoelectric point of the specimen. From the dependence of the peak temperature on the divalent impurity content, the formation enthalpy of the cation vacancy was found to be 0.57 ± 0.1 eV, which is in agreement with the value 0.6 ± 0.1 eV obtained by McGowan's indentation experiment. Dissert. Abstr.

N69-30429 North Carolina Univ., Chapel Hill.
STAGE 2 RECOVERY OF ELECTRON RADIATION DAMAGE IN NICKEL
Wynn Patterson Rickey (Ph.D. Thesis) 1968 61 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 69-1667

Samples of 99.995 and 99.98% pure nickel are irradiated with 2 Mev electrons produced by a Van de Graaff generator. The recovery of the radiation-induced resistivity increase is measured as a function of temperature, using an isochronal annealing technique. The temperature range from 60° to 240°K is investigated, and four reproducible substages of recovery activity have been found. These substages occur at 80°, 100°, 160°, and 220°K and are designated as II_A, II_B, II_C and II_D, respectively. Indications of the beginning of another substage, II_E, are found at 240°K. Experiments with different amounts of damage are carried out to determine the dependence upon defect concentration of the recovery spectrum. Recovery spectra of irradiations performed at 38° and 60°K are compared, and the production rates of damage for the two irradiations are also compared. Dissert. Abstr.

N69-30431 Northwestern Univ., Evanston, Ill.
SCATTERING OF PHONONS BY U CENTERS IN ALKALI HALIDE CRYSTALS
Lee George Radosevich (Ph.D. Thesis) 1968 168 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-1915

The scattering of phonons by H^- and D^- ions was studied in four alkali halide crystals: KCl, KBr, KI, and RbCl. These impurity ions, when introduced substitutionally into the crystals, alter the vibrational properties of these crystals. New modes of vibration appear which may have a resonant nature. The long lifetimes of these resonant modes characterize them as strong phonon scatterers. Low temperature thermal conductivity measurements are a useful tool for studying the resonant interactions if they exist. In this work the thermal conductivity of KCl, KBr, and KI containing H^- ions (U centers) and D^- ions (D centers) has been measured in the temperature range .35° to 100°K. The thermal conductivity of RbCl with U centers has been measured between 1.2° and 100K. Of these samples only KI with U and D centers exhibited a resonant dip in the conductivity curve. Dissert. Abstr.

N69-30435 Illinois Univ., Urbana.
AN EQUATION FOR MESON STATES IN THE QUARK MODEL AND ITS APPLICATION TO A MESON BOOTSTRAP
Lawrence Gray King (Ph.D. Thesis) 1968 74 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 69-1371

A differential equation for meson states is derived from the Bethe-Salpeter equation under the conditions of the quark model. The equation is shown to imply mass relations. The equation is used to attempt bootstrap calculations of the vector and pseudo-scalar meson parameters in the quark model. A bootstrap is found for the SU_3 singlet states but shown not to be possible for either the octet states or the entire $\bar{Q}Q$ system. The potential is the Fourier transform of the sum of one meson exchange Feynman graphs, with a hard core radius introduced as an adjustable parameter. Dissert. Abstr.

N69-30437 Stanford Univ., Calif.
MEASUREMENT OF NUCLEAR LIFETIMES BY THE DOPPLER ATTENUATION SHIFT METHOD
Jess Brooks Thomas, Jr. (Ph.D. Thesis) 1968 84 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 69-304

The Doppler shift attenuation method, including centroid and shape analyses, is developed in detail. The lifetimes of the Li^7(478), Be^7(432), Li^8(980), B^{10}(2150), and C^{13}(3850) levels were measured with the Doppler shift attenuation method and lithium-drifted germanium detectors. The associated radiative widths are compared in each case with the widths predicted by shell model theory. Dissert. Abstr.

N69-30438 Maryland Univ., College Park.
ELECTRON INTERACTION EFFECTS ON THE SOFT X-RAY EMISSION SPECTRUM OF METALS
Shyamalendu Mohan Bose (Ph.D. Thesis) 1968 172 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-711

An investigation of the effects of electron-electron interaction on the soft X-ray emission spectrum of metals has been carried out. The problem has been treated by using the techniques of diagrammatic many-body perturbation theory. Apart from the zero order Sommerfeld process, there are four processes in first order in effective interaction between particles, which can contribute significantly to the emission intensity. The first one corresponds to scattering of conduction electrons by the initial hole in the core energy level, the second one is associated with conduction electron scattering by the final conduction band hole. The other two terms act as interference terms. With the inclusion of these diagrams it is possible to explain the tailing of the main emission band to low energies and the presence of the plasmon satellite band which reflects the excitation of coherent long-range oscillations in the electron-density. Dissert. Abstr.

N69-30439 Stanford Univ., Calif.
ASYMMETRIC ELECTRON PAIR PRODUCTION ON CARBON
Robert Merle Simonds (Ph.D. Thesis) 1968 156 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-293

The asymmetric cross section is measured for production of single electrons or positions by photons in the energy range of the first and second pion-nucleon resonances. The experiment was designed to provide another verification of the predictions of the point interaction hypothesis of quantum electrodynamics and a first measurement of possible charge asymmetry expected from interference processes in the region of the first and second resonances. A bremsstrahlung beam was produced by passing the primary electron beam of the Stanford Mark III linear electron accelerator through a thin copper foil and removing the electron component of the resulting beam with a sweeping magnet. Electrons or positrons produced in a polystyrene (CH) target by the remaining photon beam were momentum analyzed by a magnetic spectrometer and detected by a counter telescope consisting of two plastic and two threshold gas Cerenkov counters. Dissert. Abstr.

N69-30447 California Univ., Davis.
THE NUCLEAR ENERGY LEVELS OF GADOLINIUM-154
Willard Charles Sperry (Ph.D. Thesis) 1968 158 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-829

The $^{154}Gd(p,n)^{154}Tb$ reaction was produced with 10.5 MeV protons. The decays by electron capture of the 7-1/2 hour and 20 hour states of ^{154}Tb to ^{154}Gd were examined. Gamma-ray and conversion electron spectra were measured. Thirty-two nuclear energy levels in ^{154}Gd are discussed. The empirically determined structure of ^{154}Gd is compared to several theoretical models of nuclei which have collective motion. Significant disagreements are noted, and the empirical data indicate that the unified model is not satisfactory. Dissert. Abstr.

N69-30448 Stanford Univ., Calif.
ELASTIC ELECTRON SCATTERING FROM ORIENTED Ho 165 NUCLEI
James Sidney McCarthy (Ph.D. Thesis) 1968 175 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-255

The alignment of the nuclei was perpendicular to the scattering plane and was achieved by means of the brute force technique: cooling a single crystal of Ho165 to the temperature If liquid He3 (0.35°K) and using an external field to cause domain alignment in the crystal, with a resulting nuclear alignment from the hyperfine interaction. Differential scattering cross sections are also given for randomly-aligned Ho^{165} nuclei. Detailed comparison of the experimental data was made with two separate theoretical calculations. These calculations are the best available in that they do not rely upon the Born approximation, and do take into consideration the excitation of the low-lying rotational levels of Ho^{165}. By a suitable choice for the nuclear charge distribution some agreement could be obtained with the theoretical predictions. Dissert. Abstr.

N69-30458 Northwestern Univ., Evanston, Ill.
NUCLEAR MAGNETIC RESONANCE STUDY OF THE LIGHT RARE EARTH HYDRIDES: MAGNETIC PROPERTIES AND CONDUCTION BAND STRUCTURE
Jay Patrick Nopp (Ph.D. Thesis) 1968 176 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 69-1871

In order to investigate some basic questions about the electronic structure of the rare earth hydrogen alloys, a nuclear magnetic resonance study of the light, magnetic REH_x systems has been carried out. The investigation consisted primarily of determining the dependence of the ^1H NMR on hydrogen concentration (x) and temperature in the REH_x systems (where Re = Ce, Pr, Nd, Sm, and Gd, with $2 \leq x < 3$). The major portion of the work was performed at temperatures between 4.2° and 77°K, for which an exchange gas cryogenic system was constructed. All the systems were found to have large positive (negative for GdH_x), temperature dependent ^1H Knight shifts. These shifts are due to an enhancement of the conduction electron polarization by the local atomic moments present on the rare earth ions. Dissert. Abstr.

N69-30460 Tennessee Univ., Knoxville.
ROTATIONAL DEPENDENCE OF LINE SHAPES AND SHIFTS
David Ross Cutts (Ph.D. Thesis) 1968 102 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-1237

Transitions among rotational levels have been considered as an explanation for the observed shifts and asymmetries of the vibration-rotation spectrum of hydrogen fluoride measured at The University of Tennessee. Two mechanisms have been examined as the cause of rotational transitions: transitions induced by radiation and transitions induced by collisions with other molecules. A criterion was developed which showed that the former mechanism is probably ineffective. Both mechanisms were shown to have transition rates which varied significantly from one side of a line to the other. The resulting redistribution of molecules about the center was calculated and thus the line shape was found. The shifts of the line centers were found to agree in sign, order of magnitude, and to have the same J dependence as those measured for the R branch. The P branch results did not agree; however, the J dependence of the shifts was similar to the P branch measurements of HCl obtained by other workers. Dissert. Abstr.

N69-30462 Tennessee Univ., Knoxville.
DETERMINATION OF DIFFUSION COEFFICIENTS OF THERMAL ELECTRONS WITH A TIME OF FLIGHT SWARM EXPERIMENT
De Vaughn Raymond Nelson (Ph.D. Thesis) 1968 175 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-1255

A typical time-of-flight electron swarm experiment was modified by replacing the electric field-ring assembly with a conducting paper cylinder in order to (1) increase the lateral dimension of the swarm region, and (2) remove non-conducting surfaces which become charged with electrons and prevent the zero-field condition necessary for thermal electron diffusion and capture studies in gases. A new drift-dwell-drift technique was devised whereby electron swarms were drifted to the center of the swarm region, allowed to dwell there for varying periods of time under field-free conditions, and then drifted to the anode where proper sampling with a differentially pumped electron multiplier detection system allowed the reconstruction of the swarm time-of-arrival distribution. Diffusion coefficients were determined for thermal electron swarms in noble gases. Dissert. Abstr.

N69-30466 Washington Univ., Seattle.
POLARIZATION OF LYMAN ALPHA RADIATION FROM ION ATOM COLLISIONS
T Dean Gaily (Ph.D. Thesis) 1968 124 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-1170

Polarization of Lyman alpha radiation from proton and deuteron-rare gas charge transfer collisions has been measured over an energy range of 0.6 to 15.0 keV. These results, previously published are reviewed and analyzed. Emission cross sections as well as polarization of Lyman alpha radiation from H^+ and H^+_2 collisions with ground state hydrogen atoms have also been

determined for projectile energies from 1.0 to 6.0 keV. This measurement used a crossed atomic beam technique wherein a modulated beam of hydrogen atoms from a thermal dissociation source was crossed by a beam of mono-energetic positive ions. Lyman alpha radiation from the collisionally excited atoms was detected by an ultra-violet sensitive photomultiplier tube together with a molecular oxygen optical filter. As a part of the experimental program the optical absorption characteristics of the oxygen filter in the neighborhood of Lyman alpha were investigated with results that were not predicted from an extension of earlier work.
Dissert. Abstr.

N69-30467 Stanford Univ., Calif.
CURRENT ALGEBRA APPLICATIONS IN KAON PHYSICS
Probir Roy (Ph.D. Thesis) 1968 67 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-283

Three specific problems in K-meson physics, each illustrating the application of the chiral SU(3) ⊗ SU(3) algebra of the universal hadronic currents, are considered. The first problem deals with the consistency of the soft-pion approximations in the weak, semileptonic $K_{l3}[K \to \pi e(\mu)\nu]$ and $K_{l4}[K \to \pi\pi e\nu]$ decays in understanding the value of the K_{l3} paramater Ξ. In the second problem we test the kaonic pole-dominance hypothesis in the KN system by calculating the S-wave I = 3/2 and I = 1/2 scattering lengths and the S-wave K^+P effective range and comparing with experiment. The third problem considers a low-energy dominated sum rule for Kπ scattering and the crucial relation between the accuracy of kaonic pole-dominance in the Kπ system and the existence of the κ-meson.
Dissert. Abstr.

N69-30554 Kansas Univ., Lawrence.
THE S 32(PROTON, GAMMA) Cl 33 REACTION
James Wylie Gordon (Ph.D. Thesis) 1968 151 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-17385

The study of this reaction was prompted by the apparent absence of certain low-lying states of chlorine 33. These missing states should be the analogs of those known in the mirror nucleus, S^{33}, at 1965, 2315, 2937, and 2970 keV. The excitation function of the $S^{32}(p,\gamma)Cl^{33}$ reaction was examined in detail with Ag_2S targets enriched to 99.1% in S^{32} for proton bombarding. Resonance structure in the gamma-ray yield at E_p = 2902 and 3195 keV was attributed entirely to the S^{32} $(p,p'\gamma)S^{32}$ reaction. Analysis of the gamma-ray spectra indicated radiative capture occurring at a broad resonance. Gamma rays were detected with 12.7 cm × 12.7 cm and 22.9 cm diam by 10.2 cm thick NaI(Tl) scintillation crystals and with a 15 cc coaxially drifted Ge(Li) detector. Decay schemes for each of the resonances above E_p = 1755 keV were proposed from analysis of the gamma-ray spectra and from coincidence measurements. These spectra established the existence of states in Cl^{33} at excitation energies of 1990, 2347, (2650) and 2979 keV.
Dissert. Abstr.

N69-30557 Cincinnati Univ., Ohio.
PHOTOFISSION OF Pu 238 AND Pu 239
Alvin Shapiro (Ph.D. Thesis) 1968 106 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-15212

The discussion of photofission is divided into two parts: (1) the measurement of the photofission cross-section of the plutonium isotopes, 238 and 239, and (2) the calibration of the University of Cincinnati betatron. These investigations are discussed seperately, although they both constituted integral and necessary activities to obtain the cross-sections. The photofission yield of plutonium-238 and plutonium-239, produced by the bremsstrahlung beam from the betatron, was measured between 7.5 and 11.5 Mev. Corona discharge spark chambers were used to detect fission fragments in the presence of the very high natural alpha activity of plutonium. The operating characteristics of the recently modified betatron were calibrated by measuring the bremsstrahlung spectrum (i.e., the relative number of photons per energy interval), the variation in the maximum bremsstrahlung energy with the energy control setting, and the total number of photons produced by the betatron.
Dissert. Abstr.

N69-30558# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
A FORTRAN PROGRAMME FOR THE ADIABATIC COUPLE-CHANNEL CALCULATION OF NUCLEAR PARTICLE SCATTERING BY ROTATIONAL NUCLEI
F. Fabbri and L. Zuffi 1969 17 p refs
(RT/FI(69)7) Avail: CFSTI

The program ADAPE can calculate, with the coupled-channel method, the total cross section and the total and differential elastic and inelastic scattering cross sections for spin 0 or 1/2 nuclear particles from a rotational (permanently deformed) nucleus of either even or odd A. The adiabatic approximation is assumed to be valid.
Author

N69-30561 Washington Univ., Seattle.
THE CLASSICAL LIMIT OF FOURTH ORDER MATRIX ELEMENTS FOR MESON NUCLEON SCATTERING USING PSEUDOSCALAR COUPLING THEORY
Robert Lee Capener (Ph.D. Thesis) 1968 86 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-1066

The matrix elements for the scattering of pseudoscalar mesons from nucleons using a pseudoscalar interaction has been calculated to fourth order using Heitler's expression for the compound matrix elements. The classical limit of these matrix elements was taken using the technique developed by Chetelain and an examination made of their convergence properties. These calculations have been compared to those of Page made for the case of a pseudoscalar meson interacting with nucleons by a pseudovector coupling. It has been shown that the ps–ps coupling does not lead to finite matrix elements in the classical limit.
Dissert. Abstr.

N69-30588# Lockheed Missiles and Space Co., Sunnyvale, Calif.
TRANSPORT EQUATIONS FOR MULTICOMPONENT SYSTEMS
V. S. Vikhrenko et al [1968] 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk Belorussk. SSR, Ser. Fiz.-Mat. Nauk (Minsk), no. 1, 1969 p 102–110
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Transport processes in condensed multicomponent media are studied by using statistical conditional distribution functions. A condensed system of different species of molecules is considered. Expressions for the probability of detecting a molecule of a species of specified momentum at a point are derived. The mass of the particle is determined by the assumption of a pair interaction and by applying Hamiltonian principles. A statistical derivation of the conversation laws are also presented. In conclusion, the heat flux density due to two factors, the macroscopically unobservable chaotic molecule motion and the macroscopically observable diffusion flows, is obtained.
F.O.S.

N69-30571 Illinois Univ., Urbana.
THE REACTION PROTON PROTON YIELDS PROTON PROTON POSITIVE PION NEGATIVE PION AT 7.9 BeV/c
Donald Frank Grether (Ph.D. Thesis) 1968 153 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-1350

The reaction $p\ p \rightarrow p\ p\ \pi^+\ \pi^-$ has been studied at an incident momentum of 7.9 BeV/c using an 80-inch hydrogen bubble chamber. Approximately 3600 events of the reaction were identified; the cross section was determined to be 2.54 ± .13 mb. The reaction is found to be dominated by production of the quasi-three body final state $N^{*++}\ p\ \pi^-$. A simple one pion exchange model is compared to the data and is shown to give generally good results for invariant mass distributions for the entire final state, and for mass and angular distributions for the quasi-three body state. Discrepancies between the data and the model are found to be primarily associated with enhancements in the $N^{*++}\ \pi^-$ of $p\ \pi^+\ \pi^-$ mass distributions at about 1425 MeV and 1700 MeV. Dissert. Abstr.

N69-30577 Vanderbilt Univ., Nashville, Tenn.
INFRARED, RAMAN, AND ELECTRONIC SPECTRA OF s-TETRAZINE
Larry Allen Franks (Ph.D. Thesis) 1968 108 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-17970

A study of the 5515 Å absorption system of s-tetrazine (tetraazabenzene) was undertaken for the purpose of (1) characterizing, as completely as possible, the vibrational sublevels of the ground and first excited singlet electronic states; and (2) obtaining, by a Franck–Condon analysis, the change in molecular geometry accompanying the electron promotion. To supplement these data and to provide an independent determination of the ground state asymmetry parameter the vibrational levels of the ground state were also investigated by infrared and Raman spectroscopy. In the electronic ground state, 16 of the 18 normal vibrational modes are assigned including one mode inactive in both the Raman and infrared spectrum. Mutual exclusion of Raman and infrared frequencies is observed which supports the assignment of the molecule to the point group. No evidence of nonplanarity in the ground state is found in the vibrational levels. Dissert. Abstr.

N69-30585 Boston Univ., Mass. Graduate School.
ELECTRON AND PHOTON EXCITATION OF NUCLEAR ISOMERS
John Stewart Brownson (Ph.D. Thesis) 1968 153 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-18135

This dissertation is based on an investigation of excited nuclear states whose decay populates the long-lived isomeric states of Sr^{87}, Pt^{195}, and Hg^{199}. A major advance has resulted from replacing the first Born electron scattering theory they employed with an exact partial wave theory. States were observed at 1.22 MeV, 1.88 MeV, and 2.66 MeV in Sr^{87}; at 1.13 MeV, 1.30 MeV, and 1.97 MeV in Pt^{195}; and at 1.21 MeV, 1.39 MeV, 1.49 MeV, and 1.61 MeV in Hg^{199}. Except for the 1.22 MeV state and possibly the 2.66 MeV state of Sr^{87}, all of these are new states. The ratios between the integrated photon excitation cross-sections and the inelastic electron scattering cross-sections were measured and were used with the partial wave electron scattering theory to infer the dominant multipolarity of the $I_0 \rightarrow I$ transition for seven of the states. Resonance absorption measurements were made for all states except the 1.21 MeV and 1.39 MeV states. Dissert. Abstr.

N69-30586 Pennsylvania Univ., Philadelphia.
THE NUCLEAR STRUCTURE OF F 18
Lawrence Manuel Polsky (Ph.D. Thesis) 1968 97 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-156

An experimental program was undertaken to clarify the structure of F^{18} by confirming or establishing the quantum numbers of some of the low lying levels and obtaining quantitative information on their wave functions. The program involved the study of the three reactions $O^{17}(He^3,d)F^{18}$, $O^{16}(He^3,p)F^{18}$ and $Ne^{20}(d,\alpha)F^{18}$. The reactions were induced with 15-MeV He^{3++} and 11-MeV d^+ beams from a Model EN Tandem Van de Graff accelerator, and reaction products were magnetically analyzed in a 65-cm. pole radius magnetic spectrograph. Angular distributions of the transitions to 10 final states were obtained in the $O^{17}(He^3,d)F^{18}$ study and the angular momentum transfers involved were determined. New spin and parity assignments were made to seven fluorine 18 levels. Dissert. Abstr.

N69-30587 Washington Univ., Seattle.
EXTENSION OF THE OPTICAL DOUBLE RESONANCE TECHNIQUE TO SHORT-LIVED NUCLEI
Nels Stephen Laulainen (Ph.D. Thesis) 1968 114 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-1191

The optical double resonance technique has been used to determine the hyperfine structure of the $^3P_1$ state and the nuclear spins and moments of 38-min Zn^{63}, 49-min Cd^{111m} and 55-min Cd^{105}. These experiments represent the first successful attempt to study nuclei with halflives $\leq$ one hour with this technique. The successful completion of this research conclusively demonstrates that the double resonance method is useful for nuclei with halflives as short as the 38-min halflife of Zn^{63}. These experiments were possible only through improved and more efficient isotope production and recovery techniques and through careful preselection of the operating fields and frequencies. On the basis of these experiments it should be possible to extend the optical double resonance method to nuclei with halflives as short as 10 minutes. Dissert. Abstr.

N69-30588 Vanderbilt Univ., Nashville, Tenn.
OSCILLATOR STRENGTHS OF THE RESONANCE LINES OF KRYPTON AND XENON
Joseph William Hutcherson (Ph.D. Thesis) 1968 118 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-17976

The oscillator strengths of the krypton 1164.856 Å and 1235.826 Å, and xenon 1295.58 Å resonance transitions were measured by the method of total absorption. The absorption line traces utilized a continuum produced by a repetitive condenser discharge in argon, a one-meter normal incidence vacuum spectrometer, and a sodium salicylate phosphor monitored by a photomultiplier tube. The spectrometer was used as the absorption cell in order to maximize absorbing path length, and the absorbing gas pressures were measured with a capacitance manometer calibrated against a precision gauge. The total absorption was obtained by numerical integration of the absorption line traces. Dissert. Abstr.

N69-30590 California Univ., Davis.
A STUDY OF SINGLE, DOUBLE, AND TRIPLE COMPTON SCATTERINGS AS TESTS OF GAUGE-INVARIANT MODIFICATIONS OF QUANTUM ELECTRODYNAMICS
Robert Thomas Devine (Ph.D. Thesis) 1968 100 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-846

Discussed are the limitations of gauge invariant modifications of quantum electrodynamics (QED) as providing a measure of the extent to which experiment verifies theory. The modifications usually used for the anomalous moment of the muon are shown to give ambiguous results, even for single Compton scattering. A historical review of the previous methods of calculating the single Compton cross section is presented and possibilities of alternative theories explaining the experimental results are discussed. The corresponding calculations for double Compton scattering are carried out. The calculation of the triple Compton effect is discussed for the spinor theory and the scalar (Klein–Gordon) theory. The process was evaluated for the most probable final state, in which only one photon is hard and the two remaining photons are soft. These approximations were carried out for multiple Compton scattering from Klein–Gordon particles. Predictions of both theories are given for the experimental configuration of the proposed experiments. Dissert. Abstr.

N69-30600 Illinois Univ., Urbana.
POLARON TRANSPORT IN IONIC CRYSTALS
James Alan Borders (Ph.D. Thesis) 1968 97 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-1303

A new technique was developed for making measurements on highly insulating photoconductors. This technique features ease of data reduction, relative freedom from space charge polarization, and high sensitivity and stability. Measurements were made of Hall effect, hot electron effects, and magnetoconductivity in a variety of ionic crystals. The conduction bands of seven alkali halides were found to be isotropic with a measuring accuracy of ±0.5%. Cyclotron resonance of photocarriers was observed at 139 GHz by electron heating effects. Polaron effective masses were measured in a variety of materials. Transport effects due to spin polarization were qualitatively identified in colored potassium halides. These effects were attributed to spin polarization of the F centers along with the conduction electrons. Preliminary measurements of spectral response of photoconductivity in AgBr were made and the results compared with optical absorption. Dissert. Abstr.

N69-30601 Boston Univ., Mass.
ENERGY LEVELS IN Pd 105
Ramesh Chandra (Ph.D. Thesis) 1968 115 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-18122

The Ag^{105} decay to the excited states of Pd^{105} was investigated using high resolution solid state detectors. A singles spectrum with a Ge(Li) detector, coincidence spectra with two Ge(Li) detectors, conversion coefficients for different gamma rays and conversion electron spectra with a Si(Li) detector were measured. As a result, three new gamma rays of energy 54, 75, and 527 KeV were identified. There is also a considerable improvement in the accuracy of the branching ratios and the conversion coefficients. Gamma–gamma angular correlation measurements were performed on the 64-280, 331-319, 443-644, 393-280, and 808-280 KeV γ–γ cascades, of which, the last two were not previously measured and the first three were measured by several investigators with poor agreement. In the present work, the ambiguities were avoided by using a Ge(Li) counter in conjunction with a NaI(Tl) counter. Dissert. Abstr.

N69-30602 Utah Univ., Salt Lake City.
MUON SHOWERS DEEP UNDERGROUND
Lee Grant Porter (Ph.D. Thesis) 1968 153 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-1768

Data gathered during a preliminary test of a part of the University of Utah underground neutrino detector is used in a study of showers of high energy muons at zenith angles from 30° to 75° and depths from 1500 to 8000 hg cm^{-2}. The parallelism of muon pairs in the showers is measured and indicates that the muons are part of the penetrating component in cosmic ray air showers. A characteristic width for the lateral distribution of the muons in the showers is obtained from a study of the number of muon pairs vs their spatial separation (de-coherence curve). An empirical shower density spectrum is derived by fitting a multiparameter density function to the data for single, double, and triple muon events. The arrival directions of more than 2000 underground muon showers containing two or more muons are plotted in right ascension. No anisotropy is observed. Dissert. Abstr.

N69-30604 California Inst. of Tech., Pasadena.
PHOTOPRODUCTION OF ETA MESONS FROM HYDROGEN AT PHOTON ENERGIES BETWEEN 0.8 AND 1.45 GeV
Leon S. Rochester (Ph.D. Thesis) 1968 140 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-530

The differential cross section of the process $\gamma p \rightarrow p\eta$ at the 1.5 GeV Caltech electron synchrotron, at photon energies from 0.8 to 1.45 GeV was measured, at various angles between 45° and 100° in the center of mass. A counter-spark chamber array was used to determine the kinematics of all particles in the final state of the partial mode $\gamma p \rightarrow p\eta$ ($\eta \rightarrow 2\gamma$). Analysis of 40,000 pictures yielded 6,000 events above a background which varied with energy from 5% to 30% of foreground. The cross section shows an energy dependence confirming earlier results up to 1000 MeV, but with improved statistics; it then remains roughly constant (at 50° C.M.), to 1.45 GeV. The data show a small angular variation, within the limited range covered, at energies between 1000 and 1100 MeV. Dissert. Abstr.

N69-30617 Rutgers Univ., New Brunswick, N.J.
T EQUALS 3/2 STATES IN A EQUALS 13 AND A EQUALS 17 NUCLEI
Richard George Van Bree (Ph.D. Thesis) 1968 176 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-17817

The lowest-lying T = 3/2 state in ^{13}N was investigated using the isospin-forbidden compound nucleus reaction $^{12}C + p \rightarrow {}^{31}N^{*}$. This state was observed as a resonance in the elastic excitation curve, at an excitation energy of 15.047 ± 0.02 MeV in ^{13}N, having an observed total width of 3 keV. In addition, this resonance was also observed in the yield of protons to the 2^+ and 0^+ excited states of ^{12}C, as well as the alpha particle yield to the ground and first excited states of ^{9}B. An R-matrix analysis of the data was performed which resulted in the spin-parity assignment of $3/2^-$ for this state. The total width was evaluated to be equal to 1.55 keV and the ratio $\Gamma_p/\Gamma = 0.18$ was determined. All data are in excellent agreement with the isospin-allowed pickup and stripping reactions. Theoretical calculations are underway to determine the width of this state. Dissert. Abstr.

N69-30639 Washington Univ., Seattle.
OPTICAL PUMPING STUDIES OF Cd 107, Cd 109, Cd 111, Cd 113, AND Zn 67
Philip Wardwell Spence (Ph.D. Thesis) 1968 158 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-1217

The nuclear magnetic resonance frequencies of Cd^{107} Cd^{109} Cd^{111}, and Cd^{113} and Zn^{67} have been measured in vapor samples of these isotopes by the use of an optical pumping technique. The Cd^{111} and Cd^{113} are stable and have nuclear spin I = 1/2. Spin 5/2 Zn^{67} is the only stable zinc isotope with nonzero nuclear spin. The radioactive isotopes Cd^{107} and Cd^{109} both possess nuclear spin I = 5/2 and have half-lives

of 6.7 hr and 470 days. The experiments on the radioactive isotopes represent the first realization of nuclear orientation in an isotope with spin greater than 3/2. Past attempts to orient Zn^{67} have been unsuccessful. In separate experiments the nuclear magnetic resonance frequencies of the above isotopes were intercompared through a series of direct frequency ratio measurements with at least two of the isotopes vaporized in the same absorption cell. Dissert. Abstr.

N69-30644 Northwestern Univ., Evanston, Ill.
A NUCLEAR MAGNETIC RESONANCE STUDY OF DILUTE IRON GROUP PLATINUM ALLOY SYSTEMS IN THE PARAMAGNETIC STATE
Laurence Drell Graham (Ph.D. Thesis) 1968 207 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 69-1839

A microscopic nuclear magnetic resonance investigation of the spatial distribution of the conduction electron spin polarization was performed in the host matrices of some dilute giant moment magnetic alloys in the paramagnetic state. PtFe and PtCo alloys with impurity concentrations ranging from 0.003 atomic percent to 0.07 atomic percent were studied in magnetic fields up to 16 kG and at temperatures ranging from 1.4°K to 300°K. The results suggest that the spin polarization is considerably enhanced throughout the matrices in the alloys, but that it is not of one sign, nor in any way uniform. In fact, when averaged over the great majority of lattice sites (with the exception of the sites near an impurity) the net contribution of the enhanced spin polarization to the susceptibility appears to be nearly zero. These conclusions are based on the observations that NMR measurements made on the alloys showed a considerable broadening of the distribution of Pt^{195} resonant intensity. Dissert. Abstr.

N69-30645 Pennsylvania Univ., Philadelphia.
THE EFFECT OF TWO SPIN-WAVE STATES ON THE DYNAMICS OF THE HEISENBERG FERROMAGNET
Richard Stephen Silberglitt (Ph.D. Thesis) 1968 181 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-172

The effect of spin-wave interactions on the static (thermodynamic) properties of the Heisenberg ferromagnet was calculated. Within the same approximation of including only the contributions of lowest order (two magnon) scattering processes and neglecting the kinematic interaction, the dynamic properties of this system were calculated and results were found consistent with Dyson's in the zero wave vector limit. In the short wave length limit where perturbation theory diverges nonperturbatively via the t-matrix the influence of the two spin-wave bound states and the two spin-wave resonant scattering states on the single particle spectrum are discussed as characterized by the transverse spectral weight function. Although the total cross section of the bound states is too small for them to be observed directly, the anomalous effect of the bound states and resonant scattering states on the renormalization of the spin-wave energy is observable under favorable conditions. Dissert. Abstr.

N69-30673 North Carolina Univ., Chapel Hill.
THE TEMPERATURE DEPENDENCE OF THE NUCLEAR SPIN-LATTICE RELAXATION TIME IN SEVERAL ALKALI HALIDES
Larry Milton Stacey (Ph.D. Thesis) 1968 102 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No 69-1683

The spin-lattice relaxation time T_1 was measured for the I^{127} resonance of LiI, NaI, KI, and CsI, for the $Br^{79,81}$ resonances of KBr and RbBr, and for the Rb^{87} resonance of RbBr in the temperature range from 15°K to 77°K. Except for LiI^{127}, T_1 was also measured at room temperature. Good overall agreement was found between the observed temperature dependence of T_1 and the Van Kranendonk theory of quadrupolar relaxation. Departures from the theoretical temperature dependence observed below ≈ 60°K in LiI^{127}, NaI^{127}, and KI^{127} can be attributed to structure in the phonon spectra. In these cases, the agreement is improved by adding to the Debye spectrum an Einstein peak at approximately the infrared dispersion frequency to account explicitly for the optic modes. The results of this experiment indicate that the optic modes are important to the relaxation process even at temperatures as low as 30°K. Dissert. Abstr.

N69-30677 Vanderbilt Univ., Nashville, Tenn.
BETA-CIRCULARLY POLARIZED GAMMA ANGULAR CORRELATION STUDIES OF V 48, Sc 46, AND Co 58
Andrew Meulenberg, Jr. (Ph.D. Thesis) 1968 118 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-17985

The standard forward scattering technique for the detection of the circular polarization of the gamma rays was used. A simple automatic angular correlation system was constructed to facilitate data acquisition. The energy selection of the β-rays was performed with an anthracene crystal in one ^{48}V experiment. A magnetic lens spectrometer was later used on this isotope as well as on the other isotopes. The use of this instrument has the following advantages: no scattering of electrons in air, negligible gamma–gamma coincidence background, improved energy selection of the beta rays, and elimination of interfering 511 keV annihilation radiation in the β-detector in case of positron emitters. Dissert. Abstr.

N69-30687 North Carolina Univ., Chapel Hill.
ENERGY LOSS OF ALPHA PARTICLES, PROTONS AND ELECTRONS IN MATTER
Phillip Joe Walsh (Ph.D. Thesis) 1968 116 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-1693

Assuming a simple hydrogenlike charge distribution for the atoms of a stopping material, the atomic stopping cross sections of hydrogen, helium, lithium and carbon for protons are calculated. The results for hydrogen agree with experimental data for proton energies as low as 35 KeV and the results for lithium, helium and carbon agree with experiment for proton energies as low as about 100 KeV. Experimental data is given for alpha particles penetrating acetylene, ethylene and propane and ratios of alpha particle to proton stopping cross sections in air, nitrogen, acetylene, methane and ethylene are presented for a proton energy range of 80–500 KeV. The results suggest that such ratios may depend upon a number of factors including the atomic number of the absorbing material and the presence of chemical bonds. A Si(Li) solid state spectrometer is employed to measure the most probable energy loss of 972, 626 and 365 KeV electrons in aluminum, polyethylene, mylar and mica. Dissert. Abstr.

N69-30740 Maryland Univ., College Park.
CHARGE EXCHANGE AND MOBILITY OF ATOMIC IONS IN THEIR PARENT GASES
Gerhard Friedrich Alexander Helche (Ph.D. Thesis) 1968 182 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-718

Quantum-mechanical calculations are presented for the various elastic cross sections that describe the motion of atomic ions through their parent gases. Particular attention is given to structure in the cross sections caused by wave interference effects, and to the validity of several convenient approximations which have often been used. It is assumed that the Hamiltonian for the system of electrons and nuclei contains only electrostatic potential terms, and that the Born–Oppenheimer approximation is valid. Two general results are proved. The first is that there is no interaction between

molecular states of different electronic orbital angular momentum, so that the cross sections are sums of terms, each of which depends only on one gerade-ungerade pair of molecular states. The second is an exact relation between the diffusion cross section and the charge-exchange cross section, which includes a number of new correction terms. Dissert. Abstr.

N69-30746 European Organization for Nuclear Research, Geneva (Switzerland). Nuclear Physics Div.

PROTON RESONANCE CALIBRATION AND FIELD STUDIES OF THE CERN MUON STORAGE RING MAGNET

R. C. Armstrong Brown 30 Apr. 1969 90 p refs
(CERN-69-8) Copyright. Avail: Issuing Activity

The precise measurements needed on the magnetic field of the muon storage ring for its use in the measurement of the anomalous magnetic moment of the muon are studied. The development of a proton resonance magnetometer, whose frequency is locked to variations of the magnetic field by a servo-system, and its use to determine relative and absolute field levels at a precision of 1 part in 10^5 or better are discussed. Other instruments for the stabilization of the field level in the magnet, for the measurement of the median plane, and of skew gradient components in the field, are also covered. An analytical consideration of the question of the closed orbit, and derivation of the influence of perturbations in the field distribution on the form of the closed orbit are presented. The acceptance of the magnet as a storage ring is then calculated. Finally the development of a program is described which analyzes the measured magnetic field in terms of sets of harmonic coefficients: particles introduced into this mathematical model of the magnet are followed for many orbits. By this method various aspects of the problem of beam loss after injection are studied. Author

N69-30758# Battelle-Northwest, Richland, Wash. Pacific-Northwest Lab.

RADIOISOTOPE TRANSPORT AND DEPOSITION IN FLOWING SODIUM

W. F. Brehm, E. A. Kovacevich, and D. W. Shannon Feb. 1969 24 p refs Presented at Conf. on Sodium Tech. and Large Fast Reactor Design, Argonne, Ill., Nov. 1968
(Contract AT(45-1)-1830)
(BNWL-969; CONF-681106-2) Avail: CFSTI

Transport and deposition of radioisotopes released to flowing Na from corrosion of irradiated stainless steel has been studied. Quantitative measurements of deposition can be made with sensitive counting techniques. The results indicate that ^{51}Cr and ^{60}Co are transported primarily by isotopic exchange, and do not rapidly migrate to lower temperature regions of loop systems. However, ^{54}Mn is released in larger quantities to deposit throughout the test loops. Preferential deposition sites are immediately down-stream from the source, at minimum temperature locations, and in oxygen cold traps. Author (NSA)

N69-30774 Maryland Univ., College Park, Md.

THE NEUTRON RESONANCE ABSORPTION INTEGRAL OF NATURAL DYSPROSIUM

Laurance Israel Kopp (Ph.D. Thesis) 1968 151 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-720

The natural dysprosium infinite dilution resonance absorption integral previously measured by others shows a large discrepancy with the calculated value. A different experimental method was therefore undertaken in an attempt to provide additional information with which to verify or improve existing data on this resonance integral of natural dysprosium. The reactivity change associated with the placement of a neutron absorber into a cadmium shielded region of a reactor with an inverse energy (1/E) neutron flux distribution can be expressed as $\rho = C\,N\,(RI)\,\langle\phi^*\rangle$ where ρ is the reactivity worth of the absorber, C is a constant dependent upon the location of the absorber and the composition of the reactor, N is the number of absorber atoms, (RI) is the resonance absorption integral, and $\langle\phi^*\rangle$ is an average energy importance factor. Dissert. Abstr.

N69-30801# Institut de Physique Atomique, Cluj (Rumania).

MEASUREMENT OF ISOTOPIC DISTRIBUTION IN THE EVALUATION OF OIL FIELDS [MESURE DE LA DISTRIBUTION ISOTOPIQUE DANS L'EVALUATION DES GISEMENTS PETROLIFERES]

L. Blaga *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 415–432 refs In FRENCH; ENGLISH summary (See N69-30776 17-13)
(SM-112/27) Avail: CFSTI

A general discussion is presented on the isotopic concentrations in newly opened hydrocarbon deposits which show certain regularities of distribution. The isotopic distribution existing between the different components of the fluids in oil-bearing deposits are the result of isotopic equilibrium or of a process tending towards such equilibrium. Agreement was obtained between the calculated values and those obtained, for example, in the methane-deposit water system. The isotopic concentration gradients, recorded over considerable distances within one phase, are primarily the result of a geothermal gradient. Two characteristic phases are noteworthy from the point of view of the distribution of isotopic concentration gradients in hydrocarbon deposits: (1) The starting phase of isotopic distribution, pre-existing in the deposit, is a result of the temperature gradients. This distribution can be incorporated in a system of isotopic isoconcentrates (lines of equal isotopic concentration), which can be correlated with the structure of the deposit and also with the various physical, chemical and mechanical factors characteristic of porous media. (2) The secondary phase of isotopic distribution corresponds to the period of operation. The exploitation process results in imbalances due to pressure and water flooding and in large-scale movements of oil from one zone to another. If the isotopic distribution of the starting phase is seen as an initial, natural isotopic labelling, it would appear possible to follow the changes in initial distribution as the exploration operations go on. Author

N69-30803# Office of the Government Commissioner for Atomic Energy, Warsaw (Poland).

PHOTO-NUCLEAR AND FAST NEUTRON ACTIVATION ANALYSIS OF COPPER IN COPPER ORES AND FLOTATION PRODUCTS

A. Pradzynski *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 451–462 refs (See N69-30776 17-13)
(SM-112/29) Avail: CFSTI

The existing methods of copper analysis in copper-ore processing plants are not sufficiently satisfactory for continuous process control. Two methods of activation analysis, photonuclear activation and fast neutron activation, have been examined for the purpose of analytical control of copper content in ores, tailings and concentrates. The precision of copper determination was better than 3.8% for photon activation and 4.9% for neutron activation. Calibration curves for both methods are given. The photonuclear activation method seems to be preferable because it is free from matrix effects. Author

N69-30805# Atomic Energy of Canada, Ltd., Ottawa (Ontario).

FIELD EQUIPMENT FOR NEUTRON ACTIVATION ANALYSIS

R. W. Tolmie and C. J. Thompson *In* Intern. Atomic Energy Agency Nucl. Tech. and Mineral Resources 1969 p 489–505 refs (See N69-30776 17-13)
(SM-112/31) Avail: CFSTI

Neutron activation analysis offers some appealing advantages for routine geochemical analyses. Sample preparation is simple, sensitivities are very good for many elements, several of which may be analyzed simultaneously, and the technique averages the concentration in a reasonably large sample. Neutron activation analysis equipment is now compact enough to be transported to a base camp, and is easy to operate. Such a system is described comprising an sb:Be neutron source with a pneumatic sample transport, a pair of scintillation counters in a 4-in. thick lead shield, a Ge-(Li-drift) detector, and a small computer. Applications include ore assay, rock identification, and exploration based on trace element contouring. Typical results from a variety of such applications are presented. Author

N69-30806# Texas A&M Univ., College Station. Activation Analysis Research Lab.
NEUTRON ACTIVATION ANALYSIS AND HIGH RESOLUTION GAMMA-RAY SPECTROMETRY APPLIED TO AREAL ELEMENTAL DISTRIBUTION STUDIES
R. E. Wainerdi, E. A. Uken, G. G. Santos, and H. P. Yule *In* Intern. Atomic Energy Agency. Nucl. Tech. and Mineral Resources 1969 p 507–533 refs (See N69-30776 17-13)
(SM-112/32) Avail: CFSTI

This study of the applicability of automated, instrumental thermal neutron activation analysis techniques to large scale areal elemental distribution determinations related to continental drift and to metallogenesis is presented. The Enchanted Rock batholith, Texas, was selected as an initial area in which to apply this method on the basis of the availability of independent geochemical information. Rock samples, including points from areas outside the batholith, were obtained at each of 16 sampling sites. One gram rock samples were irradiated in a thermal neutron flux of $\approx 2 \times 10^{12}$ n/cm^{2}s for 2 hours. Six trace elements (Hf, Ta, Co, Eu, Sc and La) and one minor element (Fe) were determined by gamma-ray spectrometry utilizing a 19 cm^3 Ge(Li) detector and a 3200-channel analyzer, and were areally mapped. The results indicate continuous trends in each trace element, through various rock types, over a distance of greater than 50 miles. The trace elements of pyrite, chalcopyrite and sphalerite obtained from the Philippine Islands were measured in order to apply this procedure to minerals in a location where their areal extent had not previously been studied. The methodology described above was repeated. A set of average element abundances in chalcopyrite, pyrite, and sphalerite is suggested on which to base the presence or absence of an element province or combined elements provinces. Author

N69-30866 Utah State Univ., Logan.
NEGATIVE PION PROTON MULTI-PION FINAL STATES AT 4.2 BeV/c
Robert A. Luke (Ph.D. Thesis) 1968 106 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-1078

The momentum of the incident π^- beam was 4.158±30 BeV/c. During the scanning process 1430 six-prong events were located and measured. The data was run using TVGP and SQUAW on a Univac 1108 computer. The overall cross section for six-prong production was found to be 0.4777±.0253 m barns. All possible particle combinations were analyzed utilizing invariant mass data for each possible combination. The data was searched for established resonances and the partial cross sections were calculated. Dissert. Abstr.

N69-30867 South Carolina Univ., Columbia.
NUCLEAR INTERACTIONS OF NEGATIVE PI MESONS AT 3.8 GeV/c
James Alva Warden (Ph.D. Thesis) 1968 98 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-483

A two-part experimental study is presented of negative pion–nucleus interactions at 3.5 GeV/c, using Ilford K.5 nuclear-track emulsions. The first experiment deals with diffraction scattering. Using an optical model for the nucleus, the total diffraction and absorption cross sections per unit volume are calculated. The differential cross section for diffraction scattering, averaged over the constituents of emulsion, is derived from the Kirchoff theory of scattering from a cloudy sphere. The second experiment is a survey study of the inelastic, or star, interactions found in emulsion. The predictions of several pertinent models, including the statistical model, the one pion exchange model, and the nuclear evaporation model, are examined as to validity in describing star interactions. The possibility of separating the interaction into two processes; an initial cascade and a later evaporation, is investigated. Dissert. Abstr.

N69-30873 Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany).
HAHN-MEITNER-INSTITUTE FOR NUCLEAR RESEARCH BERLIN Annual Report, 1968 [HAHN-MEITNER-INSTITUT FUER KERNFORSCHUNG BERLIN, JAHRESBERICHT 1968]
May 1969 220 p refs In GERMAN
(HMI-B-80) Copyright. Avail: Issuing Activity

Progress summaries in basic nuclear research, applied technologies, supporting scientific work, and educational activities are presented. The work was concerned with the following: (1) in nuclear chemistry: radiation effects, gases, radionuclides, and diffusion processes in solids; (2) in mathematics: numerous mathematical, statistical, and computer-related projects; (3) in nuclear physics: theoretical and experimental studies of elementary particles, nuclear structures, and nuclear reactions using a 5.5 MV Van de Graaff accelerator; (4) in radiochemistry: pulse radiolysis, reaction kinetics, and mass spectrometry of organic and inorganic materials; (5) in electronics: work connected with several computer types, a 600 keV cascade accelerator for protons and electrons, nuclear data processing, and semiconductor modules; (6) in reactor engineering: neutron measurements, irradiation experiments, and reactor safety and operations; and (7) in radiation physics: dosimetry, aerosol physics, environmental control, and radioactivity in air and water. Transl. by K.W.

N69-30875 Tennessee Univ., Knoxville.
COULOMB EXCITATION OF ROTATIONS AND VIBRATIONS IN EVEN–EVEN RARE EARTH NUCLEI
Royce Orlando Sayer (Ph.D. Thesis) 1968 250 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.25 Order No. 69-1263

The Coulomb excitation process was utilized to study rotational and vibrational states in the nuclei ^{152}Sm, ^{166}Er, and ^{172,174,176}Yb. The objectives of this investigation were to accurately measure: (1) reduced transition probabilities within the ground state rotational bands, (2) reduced transition probabilities for excitation of vibrational states, and (3) branching ratios for transitions from vibrational states to members of the ground state bands. These accurate measurements were needed to provide stringent tests for the nuclear models now in vogue for strongly deformed nuclei. Rotational states were primarily studied by means of multiple Coulomb excitation with 42–52 MeV ^{16}O ions from the Oak Ridge National Laboratory Tandem Van de Graaff accelerator. Dissert. Abstr.

N69-30891 Washington Univ., Seattle.
A STUDY OF THE GROUND STATE PROPERTIES OF LIQUID HELIUM 4
Norihiko Mihara (Ph.D. Thesis) 1968 122 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-1199

A study of the ground state properties of liquid He^4 is made using sum rules for the spectral function $S(k,\omega)$ associated with the density–density correlation function. A sharp resonance assumption for $S(k,\omega)$ yields the well-known results obtained by Feynman for the excitation energy in liquid He^4 as well as an equation for determining the liquid structure factor S(k) from a knowledge of the interparticle potential between helium atoms. This approximation for $S(k,\omega)$, which is based on both experimental and theoretical considerations, is shown to be inadequate for describing liquid helium and, in fact, inconsistent for any system. The inconsistencies are demonstrated explicitly by calculating the radial distribution function, and a modification is made to the equation for S(k) which is equivalent to introducing a width in $S(k,\omega)$. Dissert. Abstr.

N69-30893 Stanford Univ., Calif.
THE QUANTUM HARD-SPHERE GAS AT HIGH DENSITIES AND NUCLEAR POLARIZATION CORRECTIONS TO THE LEVELS OF MUONIC ATOMS
Randall Knight Cole, Jr. (Ph.D. Thesis) 1968 116 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-208

A model of hard spheres arranged in a simple cubic lattice is solved by reduction to the known one-dimensional case, and gives $A_{s.c.} = \pi^2$. The model is applied to the zero-point kinetic energies of hcp ^3He, ^4He, H_2 and D_2, as determined from pressure data. Information about the nuclear electromagnetic transition vertex derived from experimental inelastic electron scattering cross sections may be used to evaluate the nuclear polarization (dispersion) corrections to the levels of muonic atoms. The most important systematic features of nuclear excitation spectra, the Giant Dipole resonance and the quasielastic peak, are considered in detail. Numerical estimates are obtained for total level shifts of low-lying muon states in nuclei with closed proton shells, using closure approximation for the muon. The muon closure energies are considered in detail. Dissert. Abstr.

N69-30918# Stanford Univ., Calif.
HIGH ENERGY NEUTRON CROSS SECTION VALIDATION AND NEUTRON FLUX SPECTRUM USING THE HENRE SOURCE
Raymond C. Barrall, John A. Holmes, and Mae Silbergeld Kirtland AFB, N.Mex. AFSC. Air Force Weapons Lab. Mar. 1969 67 p refs
(Contract AF 29(601)-6780)
(AD-686453; AFWL-TR-68-134) Avail: CFSTI CSCL 20/8

Neutron cross sections reported by various investigators often differ far in excess of the estimates of error reported. The high neutron emission of the High Energy Neutron Reaction Experiment (HENRE) source, 10 to the 13th power n/sec, afforded an opportunity to compare measured values of many disintegration rates in a single experiment thus eliminating some of the uncertainty necessarily associated with such measurements when based on varying standards and normalizations. From these measurements, the 14.6 MeV neutron cross sections of 24 reactions are derived. The neutron spectrum near ground level at 37 feet slant range from the HENRE source was measured by using foil data and SAND II code. Author (TAB)

N69-30948# Comitato Nazional par l'Energia Nucleare, Rome (Italy).
MONTE CARLO CALCULATION OF THE ENERGY LOSS SPECTRA FOR GAMMA RAYS IN CYLINDRICAL NaI(Tl) CRYSTAL
M. Giannini, P. Oliva, and M. C. Ramorino 1969 78 p refs
(RT/F1(69)15)

A Monte Carlo calculation to determine the pulse height response on NaI(Tl) crystals to gamma rays is described. The calculation program is reliable for gamma ray energies up to 20 MeV. An improvement for what concerns the electron slowing down and the bremsstrahlung treatment has been introduced. Comparisons are made with experimental data and other calculated results. Author

N69-30951# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
NEUTRON FLUX DISTRIBUTION IN A PLANE HETEROGENEOUS CRITICAL ASSEMBLY
T. Trombetti 1969 20 p refs
(RT/FI(69)16) Avail: CFSTI

An exact solution to the neutron transport equation for a plane, heterogeneous, finite or infinite critical assembly is presented in this paper. The criticality condition corresponds to the vanishing of an infinite determinant, whose elements are given an explicit, closed form expression, which can be used directly in numerical applications. The spatial distribution of the total flux is expressed in terms of exponential functions of higher order and Gegenbauer's ultraspherical polynomials. Author

N69-30953# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
MONOENERGETIC NEUTRON TRANSPORT THEORY FOR MULTILAYER SYSTEMS AND ASSOCIATED SHIELDING PROBLEMS
V. C. Boffi and F. Premuda [1969] 39 p refs
(RT/FI(69)17) Avail: CFSTI

The exact treatment of the heterogeneity effects on the space-angle flux distributions of monoenergetic neutrons in symmetric as well as asymmetric monodimensional multilayer systems is carried out in the framework of the neutron transport theory. The associated shielding and penetration problems are also considered. Author

N69-30956# Princeton-Pennsylvania Accelerator, Princeton, N.J.
RESEARCH REPORT BY THE PRINCETON-PENNSYLVANIA ACCELERATOR FOR 1968
[1968] 21 p
(Contract AT(30-1)-2137)
(PPAR-9) Avail: CFSTI

High-energy physics research and accelerator development at the Princeton-Pennsylvania Synchrotron are summarized. NSA

N69-30975 Illinois Univ., Urbana.
THE REACTIONS NEGATIVE KAON PROTON YIELDS POSITIVE NEGATIVE SIGMA NEGATIVE POSITIVE PION, POSITIVE NEGATIVE SIGMA NEGATIVE POSITIVE PION POSITIVE PION NEGATIVE PION, AND POSITIVE NEGATIVE SIGMA NEGATIVE POSITIVE PION POSITIVE KAON NEGATIVE KAON AT 4.1 GeV/c AND 5.5 GeV/c
James Stavert Loos (Ph.D. Thesis) 1968 231 p
Avail: Univ. Microfilms: HC $10.60/Microfilm $3.00 Order No. 69-1387

The data presented and discussed were obtained from K⁻p interactions at 4.1 GeV/c and 5.5 GeV/c in the MURA thirty-inch hydrogen bubble chamber. Differential cross sections are given for the $\Sigma^+\pi^-$ final states, and the results obtained in this experiment

agree well with extrapolated results from lower energies. The data for $\Sigma^+\pi^-$ is interpreted in terms of the Regge pole model. Consistent with results from lower energies, this reaction appears to be dominated by quasi-three-body processes in which either the $Y_0^*(1405)$, $Y_0^*(1520)$, or $\rho(770)$ is produced. Cross sections and production angular distributions for the various resonance productions are given. Dissert. Abstr.

N69-30990 Stanford Univ., Calif.
SPECTROSCOPIC STUDIES OF STRONTIUM TITANATE USING IMPURITY ION PROBES
Stanley Edward Stokowski (Ph.D. Thesis) 1968 118 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-298

Studies were made of the properties of $SrTiO_3$ using the impurity ions Cr^{3+} and Mn^{4+} as probes. Sharp line fluorescence and absorption in the region of 7930 Å were observed in Cr^{3+} doped and undoped $SrTiO_3$. It is reasonably established that the fluorescence and absorption are due to the $^2E \leftrightarrow {}^4A_2$ transition (R-line) of the Cr^{3+} ion. The lifetime, selective excitation, phonon sideband, and temperature dependence of the fluorescence are described and discussed. Polarization and absorption measurements indicate that the R-line transition is of magnetic dipole character. Dissert. Abstr.

N69-30991# Australian National Univ., Canberra. Research School of Physical Sciences.
THE OPTICAL MODEL FOR LOW ENERGY HELIONS SCATTERED FROM O-16 NUCLEI
J. Nurzynski [1969] 19 p refs
(ANU-P/444)

Averaged angular distribution of elastically scattered ^3He particles from ^{16}O nuclei, obtained from measurements carried out at six incident energies between 9.802 and 10.720 MeV, has been analysed using six or four parameters in the optical-model potentials with volume or surface absorption. The existence of discrete radius ambiguities for the real part of six-parameter potentials is demonstrated. Four-parameter potentials were found to be less ambiguous and produced as good fits as those obtained with the more complex six-parameter potentials. Author

N69-30994# Australian National Univ., Canberra. Research School of Physical Sciences.
ZERO DEGREE NEUTRON YIELD FROM THE Li-7(p,n) Be-7 REACTION NEAR 2.2 MeV
H. W. Lefevre and G. U. Din [1969] 20 p refs Sponsored in part by Australian Inst. for Nucl. Sci. and Engin.
(ANU-P/449) Avail: CFSTI

A discrepancy between calculated and measured neutron spectra from this reaction is discussed. Results from a relative yield curve measurement with a long counter are compared with existing data. Author

N69-31001# Australian National Univ., Canberra. Research School of Physical Sciences.
EXPERIMENTS WITH POLARIZED DEUTERON BEAMS
J. Nurzynski [1969] 13 p refs
(ANU-P/440)

A systematic investigation of deuteron polarization with a beam of polarized deuterons is presented. The equation for the differential cross sections is derived. Among the advantages considered in using the polarized ion source, instead of the double scattering source is that it is about 133 times faster in acquiring measurement data. The measurement of polarization in direct nuclear reactions is discussed. It is concluded that polarization in elastic scattering of a variety of target materials can be studied, with limitations set primarily by the deuteron accelerator energy. F.O.S.

N69-31009# Australian National Univ., Canberra. Research School of Physical Sciences.
ANGULAR CORRELATION STUDIES OF THE LOW-LYING LEVELS OF Al-29
D. C. Kean, K. W. Carter, C. J. Piluso, and R. H. Spear [1969] 26 p refs
(ANU-P/447) Avail: CFSTI

The 1.40, 1.76, 2.23, 2.87, 3.07, 3.19 and 3.44 MeV levels of ^{29}Al were studied via angular correlation measurements of the reaction $^{26}Mg(\alpha,p\gamma)^{29}Al$. Limitations are imposed on possible spins and on multipole mixing ratios of associated gamma-ray transitions. Author

N69-31018 Northwestern Univ., Evanston, Ill.
AN ANALYSIS OF ELASTIC PION PLUS He^4 INTERACTIONS AT 129, 140, AND 150 MeV/c
Donald D. Koetke (Ph.D. Thesis) 1968 136 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-1870

This report presents an analysis of elastic $\pi^\pm - He^4$ interactions observed in Ca 50 cm liquid helium bubble chamber. Some 250,000 tracks for all $\pi^\pm - He^4$ reactions were scanned and the π^+ and π^- elastic differential scattering cross sections as well as the total cross section were measured for all inelastic reactions, in 3 momentum intervals with mean laboratory momentum 129, 140 and 150 MeV/c, respectively. We have represented the elastic scattering of π^+ and π^- due to both the Coulomb and nuclear potentials, in terms of partial wave expansions of the scattering amplitudes, taking into account long range effects of the Coulomb force. By fitting the theoretical expression for the scattering to the experimental cross sections, we have determined the pure $\pi - He^4$ nuclear phase shifts, evaluated the Coulomb corrections to the pure nuclear phase shifts, and obtained a best value for the combined charge radius of 1.1 ± 0.8 f. Dissert. Abstr.

N69-31024 Pennsylvania Univ., Philadelphia.
LOW TEMPERATURE GAMMA-GAMMA CORRELATION MEASUREMENTS OF THE HYPERFINE INTERACTIONS AT THE Sm 152 NUCLEUS FOLLOWING K-CAPTURE DECAY OF Eu 152 IN LuIG AND LuAlG GARNETS
Venancio Dela Luna Alcantara (Ph.D. Thesis) 1968 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-58

The hyperfine interactions were measured at the Sm^{152} nucleus following the k-capture decay of Eu^{152} in both the magnetic LuIG and diamagnetic LuAlG samples from 300°K down to liquid helium temperature. The method of directional angular correlation of a gamma-gamma cascade was employed. At high temperatures ($kT > \Delta$, the crystal field splitting), the results of angular correlation experiments on Sm^{+3} in the garnets are in excellent agreement with theoretical predictions and the results of other measurements. In this temperature region, relaxation of the Sm^{+3} ion is fast so that the Sm^{152} nucleus experiences the time-averaged hyperfine fields during the intermediate life time τ_N. In LuIG below the Neel temperature, the interaction of the nuclear magnetic moment with the time-averaged magnetic hyperfine field $\langle H_{eff,z} \rangle$, is large compared to the time-averaged electric quadrupole interaction. Dissert. Abstr.

N69-31047# Argonne National Lab., Ill.
INVESTIGATION OF PULSE SPECTRA FROM A SINGLE PAIR OF IONS IN A PROPORTIONAL COUNTER [ISSLEDOVANIE SPECTROV IMPULSOV OT ODNOI PARY IONOV V PROPORTSIONALNOM SCHETCHIKE]
A. A. Pomanskii et al 20 Mar. 1969 19 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Inst. Fiz. (Moscow), no. 173, 1968 Sponsored by AEC
(ANL-TRANS-739) Avail: CFSTI

Pulse spectra of single primary electrons produced by ultraviolet and x radiation in a proportional counter were determined for a variety of gases. The theory of the development of single-electron avalanches in proportional counters is discussed, and experimental procedures are described. NSA

N69-31051# Australian National Univ., Canberra. Research School of Physical Sciences.
TENSOR POLARIZATION AND REACTIONS OF DEUTERONS ON O-16 AT BOMBARDING ENERGIES OF 4.4 TO 8.4 MeV
H. Cords, G. U. Din, and B. A. Robson [1969] 36 p refs
(ANU-P/446) Avail: CFSTI

The spin tensor moments $\langle T_{20} \rangle$, $\langle T_{21} \rangle$ and $\langle T_{22} \rangle$ of deuterons from ^{16}O–d elastic scattering have been measured as a function of angle at an average deuteron bombarding energy of 8.34 MeV using the $^3He(d,p)^4He$ reaction as an analyzer. Absolute cross sections for the reactions $^{16}O(d,d)^{16}O$, $^{16}O(d,p)^{17}O$ (ground state and 0.871 MeV state) and $^{16}O(d,a)^{14}N$ (ground state) have been obtained as a function of angle at 5.755, 6.260 and 6.765 MeV and as a function of energy between 4.385 and 8.430 MeV for several angles. An analysis of these measurements has been performed using the optical model and the distorted-wave and Hauser–Feshbach theories. Author

N69-31052# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
QUANTUM CORRECTIONS TO THE COEXISTENCE CURVE OF NEON NEAR THE TRIPLE POINT
Jean Pierre Hansen and Jean Jacques Weis May 1969 15 p refs
(Rept-69/30) Avail: CFSTI

Quantum corrections to the free energy of a classical Lennard–Jones system are calculated, using the well-known Wigner expansion in powers of $\hbar$. In the vicinity of the triple point of neon, the $\hbar^4$ term turns out to be about 40 times smaller than the $\hbar^2$ term, which justifies truncation of the series after the first correction term. The resulting changes in the densities and pressures of melting and condensation transitions give rise to a phase diagram which is in good agreement with experimental neon results. Author

N69-31059# Technische Hochschule Fridericiana, Karlsruhe (West Germany). Institue fuer Struktur der Materie.
HOW WELL DOES THE MONOENERGETIC TRANSPORT EQUATION APPLY TO GAMMA RAYS? [WIE GUT IST DIE MONOENERGETISCHE TRANSPORTGLEICHUNG FUER GAMMASTRAHLEN?]
S. A. W. Garstl Aug. 1968 28 p refs In GERMAN; ENGLISH Summary
(BMwF-FBK-68-37) Avail: CFSTI

Starting from the space-, energy- and angular-dependent transport equation, the approximations concerning the energy dependency and the anisotropy of the scattering process, which lead to the monoenergetic transport equation with linear anisotropy, are discussed. After the discussion of the well-known analytic solutions of this monoenergetic equation by Kofink and Case, their application to gamma rays is investigated. The monoenergetic Klein–Nishina scattering kernel is expended into a series of Legendre polynomials; exact analytic expressions are calculated for the moments of this expansion up to any order. In the approximation treatment of the scattering cross section, by taking only the first two or three terms of the expansion into account, certain "physical domains" of the expansion coefficients can be defined by mathematical criteria. The applicability of the imposed approximations is then discussed by means of numerical examples. Author (NSA)

N69-31062# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
DIRECT CHANNEL RESONANCES, THE ASYMPTOTIC BEHAVIOUR OF THE SCATTERING AMPLITUDE AND THE DEGENERACY OF THE RESONANCE LEVELS
A. Krzywicki 30 May 1969 8 p refs
(Rept-69/38) Avail: CFSTI

It is shown, under rather general conditions, that the duality implies the following alternative: either the number of mass degenerate resonances increases very rapidly (exponentially, if resonances disintegrate according to the statistical model) with the resonance mass, or there exist very strong selection rules that effectively forbid most of the disintegration channels for a class of heavy resonances. Author

N69-31074 Virginia Univ., Charlottesville.
SPECTRA OF CHARACTERISTIC AND CONTINUOUS RADIATION FROM A WINDOWLESS X-RAY TUBE
Jerry Norwood Crout (Ph.D. Thesis) 1968 155 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-18191

The spectrum of the radiation emitted by an x-ray tube has been measured for a windowless tube whose target was successively vanadium, chromium, and tungsten, operated at voltages from 6 to 20 kilovolts. The spectral range 1.45 to 20 keV was investigated with about 1% resolution, 10% relative accuracy, and 30% absolute accuracy, using a flat-crystal vacuum spectrometer with a flow proportional counter. Radiation was observed at an angle of 23° from the target surface and at right angles to the direction of travel of the incident electrons. Dissert. Abstr.

N69-31083# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
A RELATIVISTIC TREATMENT OF THE THREE-BODY FINAL STATE IN THE PHOTOPRODUCTION OF π ON DEUTERON
J. P. Leroy, J. Michali, and D. Pignon May 1969 28 p refs
(Rept-69/25) Avail: CFSTI

The problem of the three body corrections in the final states of spinning particles is studied and applied to the photoproduction on the deuteron: $\gamma d \rightarrow NN\pi$. Particular attention is paid to the kinematical singularities of the problem. Author

N69-31085# Australian National Univ., Canberra. Research School of Physical Sciences.
ENERGY LEVELS IN Co-67, Co-69, Co-81 FROM THE Ni-60, Ni-62, Ni-64(p,α) REACTIONS
K. L. Coop, I. G. Grahm, J. M. Poate, and E. W. Titterton [1969] 22 p refs
(ANU-P/421) Avail: CFSTI

Enriched targets of $^{60,62,64}Ni$ have been bombarded with protons of energies ranging from 9.5 to 10.5 MeV. Alpha particles populating levels in $^{57,59,61}Co$ were analyzed magnetically using a Buechner broad-range spectrograph with photographic-plate detection. Several new energy levels were found in ^{61}Co including the third excited state which has been located at 1.287 MeV. Some nuclear systematics of the odd-mass cobalt isotopes are discussed. Author

N69-31091# Illinois Univ., Urbana. Dept. of Physics.
THE PI-MINUS PROTON OMEGA CHANNEL IN PI-MINUS PROTON INTERACTIONS AT FIVE BeV
Alexander Shapiro (Ph.D. Thesis) 1969 58 p refs
(Contract AT(11-1)-1195)
(COO-1195-159) Avail: CFSTI

The results of an investigation of the reaction $\pi^- p \rightarrow \pi^- p\omega$ at an incident pion momentum of 5 BeV/c are presented. The data for this study were obtained with the 72-inch hydrogen bubble chamber. N^{*0} production and B production were both observed. From a moment analysis of the angular distributions in the sequential decays $B \rightarrow \omega\pi$, $\omega \rightarrow 3\pi$, the B is found to have either $J^P = 1^+$ or $J^P = 2^+ 3^- 4^+ \ldots$. A qualitative argument against the $J^P = 2^+ 3^- 4^+ \ldots$ assignments is made on the basis of the observed polarization of the B. Author (NSA)

N69-31120# Australian National Univ., Canberra. Research School of Physical Sciences.
RESONANCES OF THE Mg 26(PROTON, GAMMA) REACTION BETWEEN 660 AND 1000 keV
F. C. P. Huang and T. R. Ophel [1969] 29 p refs
(ANU-P/423) Avail: CFSTI

Gamma ray spectra of the 661, 719, 809, 839, 954 and 982 resonances of the $^{26}Mg(p,\gamma)$ reaction were obtained with a Ge(Li) detector. The decay schemes of the resonances and angular distribution measurements enabled spin assignments to be made for several MeV levels. Author

N69-31133# Lehigh Univ., Bethlehem, Pa.
PRELIMINARY INVESTIGATIONS OF PURE AND ACTIVATED CdF SUB 2 AND OF PbWO SUB 4
H. Blume and Wesley J. Van Sciver 7 Jan. 1969 13 p
(NYO-3409-31) Avail: CFSTI

At LHeT (liquid helium temperature) pure CdF_2 exhibits two emission bands upon UV excitation: a high energy emission centered at about 380nm, which can be excited mainly below 190 nm, and a low energy emission emitted above 460 nm, which can be excited with much smaller efficiency between 220 and 300 nm. The high energy emission decays with a time constant of 135 nsec and the low energy emission with 3 ± 1 μsec. Upon ^{60}Co γ irradiation pure CdF_2 yields scintillation pulses suitable for particle detection at LHe and LNT. The scintillation pulse decays at LHeT with a fast decay component of 135 nsec decay time, belonging probably to the high energy emission, and a much weaker slow component of several μsec decay time, belonging very likely to the low energy emission. Author (NSA)

N69-31140# Gulf General Atomic, San Diego, Calif. Accelerator Physics Dept.
NEUTRON CAPTURE GAMMA RAY FACILITY USING AN ELECTRON LINEAR ACCELERATOR
V. J. Orphan, C. G. Hoot, A. D. Carlson [1968] 38 p refs Sponsored by AEC Prepared for Oak Ridge Natl. Lab., Tenn.
(GA-9221) Avail: CFSTI

A versatile facility for the study of resonance neutron capture gamma ray spectra with high energy resolution is described. An electron linear accelerator is used to provide a pulsed beam of neutrons. Gamma ray spectra are measured using a Ge(Li)–NaI(Tl) spectrometer. The gamma ray pulse height and the neutron time-of-flight information are stored using an on-line computer. The salient features of the capture facility are described and spectra resulting from the capture of neutrons in natural tungsten are displayed. Author (NSA)

N69-31143# Commissariat a l'Energie Atomique, Brussels (Belgium).
NUCLEAR ENERGY IN BELGIUM, 1963–1967 [L'ENERGIE NUCLEAIRE EN BELGIQUE, 1963–1967]
1967 151 p In FRENCH
Avail: CFSTI

The progress of Belgium in its four-year (1963–1967) program directed toward the peaceful uses of atomic energy is presented. The organization of the governmental agencies and financial supporting groups controlling the public and private sectors was described as well as the international scope of Belgian technical planning, industrial applications, and public involvement in the program. Nuclear reactors in Belgium, institutions with contracts for fundamental research in nuclear chemistry and physics, and the national and international societies in which Belgium is a cooperating member are also documented. M.H.E

N69-31145# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Siebersdorf.
HIGH ENERGY GAMMA RAYS OF As 76 FOLLOWING THERMAL AND EPITHERMAL NEUTRON CAPTURE
P. Gryksa, P. Riehs, and K. Rumpold 1969 14 p refs Submitted for publication
(SGAE-PH-80/1969) Avail: CFSTI

Using a Ge(Li)-detector, the energies and intensities of the high energy gamma transitions of the reaction $^{75}As(n,\gamma)^{76}As$ have been measured. By comparison between gamma ray intensities in thermal and epithermal neutron capture, 6 intense transitions are found to be due mainly to direct neutron capture. A classification of gamma ray intensities after epithermal neutron capture indicated an El multipolarity for 8 gamma transitions. A determination of the binding energy, using the ^{36}Cl gamma energies for calibration, gave 7330 ± 4 keV. Author

N69-31156# Washington Univ., St. Louis, Mo.
DELAYED PARTICLE SPECTROSCOPY Technical Progress Report, 1 May 1968–30 Apr. 1969
Paul L. Reeder 30 Jan. 1969 17 p refs
(Contract AT(11-1)-1608)
(COO-1608-4) Avail: CFSTI

Delayed-neutron yields from ^{209}Bi, ^{232}Th, and ^{238}U bombarded by ^3He and α beams were measured. Delayed-neutron yields and spectra were also measured for the spontaneous fission of ^{252}Cf. A recoil collection technique was developed to study delayed protons and alpha decay. The alpha decay of ^{212}At was studied. An attempt is in progress to measure the delayed-proton spectrum for ^{41}Ti. The γ spectra from the decay of ^{42}Ti was measured. NSA

N69-31160# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
INVESTIGATION OF UNIVERSAL PLASMA INSTABILITIES Quarterly Report, 1 Sep. 1968–30 Nov. 1968
H. Lashinsky 30 Nov. 1968 13 p refs
(Contract AT(40-1)-3405)
(ORO-3405-26; QR-11) Avail: CFSTI

A brief summary of research on drift waves and active Fabry–Perot microwave resonators is presented. The drift-wave studies were made in a single-ended Q machine filled with potassium. NSA

N69-31162# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.
NUCLEAR CHEMISTRY RESEARCH Technical Progress Report, 15 Dec. 1967–15 Dec. 1968

Nathan Sugarman and Anthony Turkevich 15 Dec. 1968 12 p
(Contract AT(11-1)-1187)
(COO-1187-6) Avail: CFSTI

Research progress is reported on the following topics: production of heavy nuclides in the 440-MeV fission of uranium; ^{65}Zn, Ni, Cu, and Zn contents of Bogou iron meteorites; radionuclide production cross sections in copper with 90 to 440 MeV protons; radiochemical analysis of freshly fallen meteorites; meson spallation of copper; high-energy fission of bismuth and tantalum; amounts of heaviest elements in returned lunar material; recoil studies of isomeric nuclides; evidence for a (p,pα) spallation reaction; production of heavy nuclides from uranium by multi-GeV protons, and a germanium–lithium detector for gamma spectroscopy. NSA

N69-31172# Australian National Univ., Canberra. Research School of Physical Sciences.
COMPOUND AND DIRECT PROCESSES IN PROTON ELASTIC SCATTERING FROM P 31 AND Ni 62
P. J. Dallimore, W. F. Davidson, and J. Hellstroem [1969] 37 p refs
(ANU-P/442) Avail: CFSTI

Absolute differential cross sections were measured for the elastic scattering of protons from ^{31}P and from ^{62}Ni. For ^{31}P the measurements were taken in 10 keV steps from 8.00 to 8.20 MeV and at 27 angles. For ^{62}Ni six angular distributions were measured between 8.00 and 8.05 MeV. The averaged angular distributions were analyzed using the optical model and Hauser–Feshbach theories. The effect of reducing the Hauser–Feshbach contribution to allow for direct interaction competition was investigated. Author

N69-31173# Australian National Univ., Canberra. Research School of Physical Sciences.
THE REACTION Na 23(PROTON, PROTON) IN THE RANGE 8.0 TO 12.0 MeV. PART 1: ANALYSIS OF AVERAGE ELASTIC CROSS SECTIONS
J. Hellstroem, P. J. Dallimore and W. F. Davidson [1969] 25 p refs
(ANU-P/426) Avail: CFSTI

Absolute differential cross sections were measured for the elastic scattering of protons from ^{23}Na. Excitation functions were measured in 20 keV steps for incident proton energies from 8.0 to 12.0 MeV and at 23 different angles. Average angular distributions every 0.5 MeV were obtained from smooth fits to the excitation functions and these were analysed using the optical model and Hauser–Feshbach theories. The variations with energy of the optical model potentials, the compound nucleus reduction factor, and the amount of compound nucleus and direct reaction cross sections were investigated. There is some evidence for the presence of intermediate structure in the compound nucleus magnesium 24. Author

N69-31174# Australian National Univ., Canberra. Research School of Physical Sciences.
THE BETA-DECAY OF B 8 AND 2 PLUS STATES OF Be 8
G. J. Clark, P. B. Treacy, and S. N. Tucker [1969] 16 p refs
(ANU-P/453) Avail: CFSTI

The beta-decay of ^{8}B was investigated by measuring the energy distribution of the α-particles from subsequent break-up of ^{8}Be. The data were analyzed, in conjunction with data from α–α elastic scattering, in a three-level R-matrix formalism. Consistent fits are obtained for channel radius (6.0 ± 0.5)fm, and the existence of a broad 2^+ state of beryllium 8 near 12.0 MeV, of width 14 MeV, is confirmed. Author

N69-31176# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
ESTIMATION OF THE DIFFERENTIAL ASYMMETRY FOR γ d YIELDS np AND np YIELDS γ d INDUCED BY T-VIOLATION
J. P. Leroy, J. Micheli, D. Pignon, and D. Schiff [1968] 9 p refs
(Rept-69/31) Avail: CFSTI

A relativistic calculation is presented in order to evaluate the asymmetry for the reactions γd → np and np → γd induced by a T-violation in the γNN* vertex in the domain of energy 200–320 MeV. Author

N69-31188# California Univ., Berkeley. Lawrence Radiation Lab.
TURBULENCE IN THE POSITIVE COLUMN OF A GLOW DISCHARGE
Martin W. Halseth (Ph.D. Thesis) Feb. 1969 113 p refs
(Contract W-7405-ENG-48)
(UCRL-18678) Avail: CFSTI

The helical instability, which first appears in the positive column of a glow discharge at a critical magnetic field, B_c, is found to be replaced by random oscillations when the magnetic field is greater than 15 times the critical field. Measurement of the correlation of the ion density at two points along a tube diameter shows that the oscillations are out of phase with each other by more than 90 deg when the points are on opposite sides of the tube and the field is less than 15 times B_c, indicating that a helical oscillation is present. When B/B_c is greater than 15, the correlation decays exponentially with radial separation of the two points and remains positive, or nearly so, as in a turbulent plasma. The radial exponential decay length, which corresponds to the turbulent mixing length, and the radial density profile show good agreement with calculations made from a theory for turbulence in the positive column, proposed by Kadomtsev. Author (NSA)

N69-31189# California Univ., Livermore. Lawrence Radiation Lab.
NATURAL FREQUENCIES FOR A RECTANGULAR BASIN ON A BETA-PLANE
W. P. Crowley 16 Jan. 1969 13 p refs Sponsored by AEC
(UCRL-50574) Avail: CFSTI

The natural frequencies for barotropic flow in a rectangular basin on a beta-plane for both the free-surface and the fixed-surface cases are determined as functions of the aspect ratio of the basin and the Coriolis parameter by two different methods. Author (NSA)

N69-31212# California Univ., Berkeley. Lawrence Radiation Lab.
CHARACTERIZATION OF MULTICHANNEL SOURCES AND DESIGN OF MOLECULAR BEAM SYSTEMS FOR THEIR UTILIZATION
R. H. Jones, V. R. Kruger, and D. R. Olander Dec. 1968 72 p refs
(Contract W-7405-ENG-48)
(UCRL-17859) Avail: CFSTI

An apparatus for measuring the leak rates and angular distributions of the molecular flux from multichannel sources was constructed. Four types of beam sources were tested: a single capillary, a krinkly-foil stack, an electron-beam-milled quartz membrane, and two sources constructed by fiber optics techniques (Mosaic sources). The leak rates of the sources were compared to the predictions of Knudsen flow. The conductances of the Mosaic sources were 30 to 60% smaller than expected, possibly because of blockage of some of the channels. The conductances of the

quartz-membrane and krinkly-foil sources were considerably greater than the values predicted by Knudsen flow indicating the presence of leakage paths other than the observed channels. The conductance of the single-capillary source was close to theory. The angular distributions were characterized by a peaking factor, defined as the ratio of the center-line beam intensity from the source to that from a cosine emitter of the same total flow rate. Author (NSA)

N69-31238# Kernforschungszentrum, Karlsruhe (West Germany) Institut fuer Kernverfahrenstechnik.

OPERATION OF A 10-STAGE SEPARATION NOZZLE PILOT PLANT

E. W. Becker, G. Frey, R. Schuette, and D. Seidel Oct. 1968 13 p refs Presented at the Symp. on Probl. Bearing on Isotope Separation of Uranium, Turin, Italy

(KFK-854; CONF-681015-3) Avail: AEC Depository Libraries

A computer analysis of the steady-state and transient behavior of a small separation nozzle cascade indicated that the system was inherently stable. Therefore, the pilot plant was constructed without any automatic control installations. Equipment design and arrangement for the plant are discussed. Plant operation was stable with an overall enrichment factor of 1.082. NSA

N69-31247# Brookhaven National Lab., Upton, N.Y.

DEPENDENCE OF THE THERMAL DECOMPOSITION INDUCTION PERIOD ON PRIOR GAMMA- AND X-RAY IRRADIATION

P. J. Herley (Picatinny Arsenal) and P. W. Levy 1969 21 p refs Presented at the Meeting of the Western States Sect., the Combust. Inst., China Lake, Calif., 30 Apr.–2 May 1969 Sponsored by AEC

(BNL-13423; Conf-690405-1) Avail: CFSTI

This relation describes the ammonium perchlorate results over a dose range of 10^2 to 10^7 R. In order to relate it to both thermal decomposition kinetics and radioinduced processes (induction period) vs. (total dose) equations were derived for a variety of different conditions. These represent combinations of the linear, power law, and exponential induction period kinetics and linear, exponential, and saturating exponential nuclei growth kinetics during irradiation. In addition it is necessary to make assumptions about the induction period processes. The most important are: Before heating the material contains a fixed number of potential nuclei forming sites, which increase in size during heating until they reach a critical size. Having attained this size the induction period process is superseded by one of the acceleratory period processes. It is also assumed that the radioinduced and thermally induced nuclei growth kinetics may be different. Author (NSA)

N69-31248# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

KINEMATICS AND REGGE DYNAMICS OF QUASI-TWO-BODY N-N INTERACTIONS

Doan Nhuong and R. M. Muradyan 1969 28 p refs

(JINR-E2-4286) Avail: AEC Depository Libraries

The quasi-two-body nucleon–nucleon reactions $N + N \rightarrow N + \Delta(1236, 3/2^+)$ $N + N \rightarrow N + N^*(1518, 3/2^-)$ $N + N \rightarrow N + N'$ (1470, $1/2^+$) are considered in the framework of the Regge theory. The conspiracy relations, the threshold and pseudothreshold constraints imposed on the t-channel parity-conserving helicity amplitudes are derived. From the factorization of the Regge-pole amplitudes some information about conspiracy or evasion is obtained. The Regge-pole formulas for the differential cross sections and the spin density matrix elements are given. NSA

N69-31250# Gulf General Atomic, San Diego, Calif.

CONTROLLED THERMONUCLEAR RESEARCH PROGRAM Summary Progress Report, 1 Jul. 1967–31 Jul. 1968

P. H. Miller, Jr. and T. Ohkawa 15 Sep. 1968 102 p refs

(Contract AT(04-3)-167)

(GA-9003) Avail: CFSTI

Experiments with the quadrupole device were started and were essentially completed during fiscal year 1968. The results are summarized. The data from both quadrupole and octupole devices show good confinement of plasma. The plasma lifetime is at least one order of magnitude greater than Bohm time. NSA

N69-31251# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

CONTRIBUTION OF ANALOG CALCULATION TO THE STUDY OF THE WAVE-PARTICLE INTERACTION IN HIGH-FREQUENCY PLASMA STRUCTURE [CONTRIBUTION DU CALCUL ANALOGIQUE A L'ETUDE DE L'INTERACTION ONDE-PARTICULES DANS LES STRUCTURES HAUTE FREQUENCE A PLASMA]

R. Collet, G. Ichtchenko and D. List 1968 38 p refs In FRENCH Presented at Intern. Symp. on Analogue and Hybrid Computation Appl. to Nucl. Energy, Versailles, France, 16 Sep. 1968

(CEA-CONF-1128; CONF-680941-3) Avail: AEC Depository Libraries

In order to define the energy exchanges between the high frequency source and the particles in plasma accelerators at Saclay, the dynamics of the charged particles was studied in a system of high frequency electromagnetic fields and nonuniform static magnetic fields. There are high coupling zones between the wave and the particles when the gyration frequency of the electrons (or the ions) is close to the frequency of the wave. Significant energy transfer results. The selection of the analog calculation is motivated by the purpose of the study (tracing of trajectories and study of the evolution of magnitudes connected with the particle) and by the properties of the differential system obtained. A formulation as simple as possible of the plasma acceleration phenomenon is proposed, eliminating the parameters whose influence can be neglected in the conditions studied. A solution type characterizing the resonance phenomenon, which facilitates an analytical approach of the solution, is sought. Author (NSA)

N69-31261# Scientific Translation Service, Ann Arbor, Mich. Oak Ridge National Lab., Tenn.

STUDY OF ELECTRON-PHOTON SHOWERS PRODUCED BY GAMMA-QUANTA WITH ENERGIES OF 100, 200, 500, and 2000 MeV IN LIQUID XENON

E. Slovinskii, Z. S. Strugal'skii, and B. Yanovskaya [1968] 12 p refs Transl. into ENGLISH from Russian Rept. JINR-P1-3919 Prepared for Oak Ridge Natl. Lab.

(ORNL-TR-3022; JINR-P1-3919) Avail: CFSTI

The fluctuations of the longitudinal development of showers caused by γ quanta with energies of 100, 200, 500, and 2000 MeV were studied by means of a xenon bubble chamber. Some properties of a cascade process in the medium are deduced from this experiment and listed. NSA

N69-31269# Oak Ridge National Lab., Tenn.

SORPTION OF FISSION PRODUCT (NIOBIUM, RUTHENIUM) FLUORIDES ON SODIUM FLUORIDE

E. D. Nogueira and G. I. Cathers Apr. 1969 58 p refs

(Contract W-7405-ENG-26)

(ORNL-TM-2169) Avail: CFSTI

An experimental study of the sorption of some fission product (niobium and ruthenium) fluorides on fixed beds of sodium fluoride was made in order to obtain a better understanding of the sorption–desorption methods for purifying uranium hexafluoride. Two

types of experiments were conducted. First, deep sodium fluoride beds that were subdivided into sections were used to investigate the removal of niobium (and ruthenium) pentafluorides from a gas stream as a function of temperature and bed height. Later, single layers of sodium fluoride particles were used to study the removal of niobium pentafluoride as a function of its concentration in the gas and of solid surface area. The sorption process was followed with the tracers ^{95}Nb and ^{103}Ru. Experimental data were obtained in the temperature range 100° to 600°C and at niobium pentafluoride concentrations below a partial pressure 0.05 mm Hg. Author (NSA)

N69-31280# Atomic Energy Establishment, Winfrith (England).
MEASUREMENT OF THE AXIAL VARIATION IN SENSITIVITY OF 1/4-INCH DIAMETER FISSION CHAMBERS
G. D. Burholt Oct. 1967 22 p refs
(AEEW-M-788) Avail: CFSTI; HMSO 4s

Measurements were made of the axial variation in sensitivity of two 1/4-inch diameter ^{238}U fission chambers, and the effective center of each was determined by measuring the response of the chambers as they were scanned by a collimated beam of neutrons. The effective center was determined with an error of ±0.006 inch, whereas the physical center could only be estimated to within ±0.014 inch. The effects of axial nonuniformity of sensitivity were considered for measurements in high neutron flux gradients, and it was shown that small corrections were required in some cases. Author (NSA)

N69-31282# Argonne National Lab., Ill.
PROBLEM OF THE RADIATION LOAD BY INCORPORATION [ZUR FRAGE DER STRAHLENBELASTUNG DURCH INKORPORATION]
L. A. Koenig Jan. 1969 12 p refs Transl. into ENGLISH from Atompraxis (Germany), no. 14, 1968 p 467–470
(ANL-Trans-717) Avail: CFSTI

Results of calculations for a number of radionuclides, which are of a particular interest in radiological protection, of the radiation load at the incorporation of 1.0 μCi and of the maximum permissible loading of the critical organ with nuclide are presented. NSA

N69-31288# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
THE DELTA I EQUALS ONE-HALF RULE IN KAON YIELDS THREE PION DECAYS
A. Neveu and J. Scherk May 1969 17 p refs
(LPTHE-TH-69/32) Avail: CFSTI

A detailed discussion of the corrections on the ordinary predictions of the $|\Delta I| = 1/2$ rule is presented. Corrections considered are: (1) electromagnetic corrections, (2) Dalitz plot deformation from pion mass differences, (3) pion mass differences in the amplitude, and (4) other electromagnetic effects. The slope ratio is considered to be a more conclusive test of the hypothesis; however, the inaccuracy of the experimental results prevent a significant conclusion. Tables summarizing data are included. F.O.S.

N69-31299# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
Pm-147 RADIOISOTOPE APPLICATION PROGRAM AMBA HEAT SOURCE Final Report
N. C. Davis and D. W. Bitts Mar. 1969 77 p refs
(Contract AT(45-1)-1830)
(BNWL-994) Avail: CFSTI

A promethium-147 fueled 60-W thermal source was fabricated for the Air Force for use in heating a navigation device for the Advanced Manned Strategic Aircraft (AMSA) Program. A high strength impact resistant capsule was designed, and a capsule fabrication process was developed. A series of dummy (SM_2O_3 stand-in for $^{147}Pm_2O_3$) capsules were fabricated, impact tested, and destructively evaluated to demonstrate process quality and to determine impact strength. Process and quality control inspection procedures were established and the $^{147}Pm_2O_3$ fueled capsule was produced and delivered for laboratory testing and flight demonstration of AMSA navigational equipment. Author (NSA)

N69-31312# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Kernverfahrenstechnik.
PRINCIPLES AND ECONOMIC ASPECTS OF THE SEPARATION NOZZLE PROCESS
E. W. Becker, W. Bier, and R. Schuette Oct. 1968 13 p refs Presented at the Symp. on Probl. Bearing on Isotope Separation of Uranium, Turin, Italy
(KFK-853; CONF-681015-2) Avail: AEC Depository Libraries

A process for enriching ^{235}U, based on pressure diffusion in supersonic jets, is described. A mixture of 5 mole % UF_6 and 95 mole % He is expanded through a slit shaped nozzle. Deflection of the jet by curved walls results in a partial spatial separation of the components; the gas moving close to the deflecting wall becoming enriched in ^{235}U, while ^{238}U accumulates in the remaining fraction. Economic aspects of the process are considered. NSA

N69-31313# Oak Ridge National Lab., Tenn.
TRITIUM LOSS FROM TRITIUM SELF-LUMINOUS AIRCRAFT EXIT SIGNS
R. G. Niemeyer 25 Mar. 1969 12 p refs
(ORNL-TM-2539) Avail: CFSTI

A study of tritium loss from self luminous aircraft exit signs during certain normal and abnormal conditions is described. The amount of tritium oxide was determined in each case since the biological effect of the oxide is much greater than that of elemental tritium. It was found that ≈2% of the tritium in the light sources was in the form of tritium oxide. Of the total tritium released from a broken exit sign, ≈99% occurred during the first 1.75 hr. It was concluded that the permeation rate of tritium through the glass tubes is so low as to be inconsequential from a safety standpoint. Author (NSA)

N69-31330# Australian National Univ., Canberra. Research School of Physical Sciences.
GAMMA RADIATION FROM THE F-19 (p,alpha gamma) O-16 REACTION BETWEEN 1.9 MeV AND 4.16 MeV
C. H. Osman, D. M. Rossiky, and D. J. Baugh [1968] 23 p refs
(ANU-P/450) Avail: CFSTI

The $^{19}F(p,\alpha\gamma)^{16}O$ reaction was studied. Total cross sections for transitions from the 6.13, 6.92, 7.12 and 8.88 MeV states in ^{16}O were measured between 1.9 and 4.16 MeV in 20 keV steps. Line shape analysis of Doppler broadened Ge(Li) γ-ray lines was employed. Author

N69-31338*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYSIS OF A MOLECULAR BEAM SYSTEM UTILIZING A KNOWN PRESSURE SOURCE
Alphonsa Smith Washington Jul. 1969 28 p refs
(NASA-TN-D-5308) Avail: CFSTI CSCL 20H

An analysis is presented of a molecular beam system which utilizes the combined techniques of pressure attenuation, molecular beaming, and cryopumping to produce accurately known pressures in the ultrahigh vaccum region. The system is shown to have a known molecular density with a maximum uncertainty of 6 percent over a variable range of pressures from 6.65×10^{-11} to 1.33 $\times 10^{-5}$ newton/meter^2 (5×10^{-13} to 10^{-7} torr). The

kinetic behavior of gas flow in each component of the system is analyzed to determine the important system parameters and to establish their optimum values so that a maximum range of beam density is obtained. Author

N69-31398*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
IMPACT IONIZATION AND THE TUNNELING EFFECT DURING ELECTROLUMINESCENCE OF ZINC SULFIDE [UDARNAIA IONIZATSIIA I TUNNELNYI EFFEKT PRI ELEKTROLIUMINESTSENTSII SULFIDA TSINKA]
L. A. Kosyachenko Washington NASA Jul. 1969 10 p refs Transl. into ENGLISH from Zh. Prik. Spek., Akad. Nauk Belorussk. SSR (Minsk), v. 9, Nov. 1968 p 830–836
(Contract NASw-1692)
(NASA-TT-F-12405) Avail: CFSTI CSCL 20H

The roles of impact ionization and of the tunneling effect in the excitation of electroluminescence in typical ZnS electroluminophores are studied. It is experimentally found that the impact ionization coefficients for electrons and holes are equal. The voltage dependence of the current introduced into the barrier is established. It is shown that at high voltage values, the current introduced into the barrier rises due to a tunnel mechanism. Various cases of this general behavior are discussed. Author

N69-31400# Argonne National Lab., Ill.
RANGE AND IONIZATION LOSSES OF PROTON ENERGY IN DIFFERENT MATERIALS
I. M. Vasilevskii et al [1969] 25 p refs Transl. into ENGLISH from Russian Rept. JINR-P1-4081
(ANL-Trans-724; JINR-P1-4081) Avail: CFSTI

By the Bragg curve method the 660-MeV proton paths in C, Al, Cu, and Pb are measured. By using the differential ionization chamber the relative ionization losses of the proton energy are determined for different matters in the energy range 100 to 600 MeV. The experimental results are in agreement with the theoretical values at the ionization potentials. Author (NSA)

N69-31445*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
ENERGY LEVELS OF HIGHLY-ENERGIZED IONS, ON THE BASIS OF A HYDROGEN-LIKE MODEL
P. P. Pavinskiy et al Washington NASA Jul. 1969 15 p refs Transl. into ENGLISH from the book "Urovni Energii Mnogozaryadnykh Ionov Na Osnove Vodorodopodobnoy Modeli" Leningrad, Vestn. Leningr. Univ., no. 22, 1968 p 11–19
(Contract NASw-1692)
(NASA-TT-F-12408) Avail: CFSTI CSCL 20H

A method of calculating the energy levels of highly-energized ions with one optical electron is proposed. The method is based on the general scheme of quantum-mechanical computations, together with the hydrogen wave functions. The hydrogen-like model for n closed shells is used both for approximating the electron density of the ion core, and for the potential. The model is generalized in the second part of this study to include cores which consist primarily of arbitrary sets of *l*-shells. Some numerical values of the parameters are quoted in the table. Author

N69-31451# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Institut Fiziki Vysokikh Energii.
CONCERNING KINEMATIC LIMITATIONS ON THE AMPLITUDE OF PHOTOPRODUCTION IN O(4)
V. S. Zamiralov and G. I. Shepelov 1968 5 p In RUSSIAN refs
(IFVE-STF-68-46-K) Avail: AEC Depository Libraries

The production of pions on the nucleons is considered in the scheme of the O(4) symmetry, proposed by Freedman and Wang. It is shown that the production amplitude vanishes at t = 0 if the mass of the virtual photons equals that of the pion. Author (NSA)

N69-31482# Princeton Univ., N.J. Palmer Physical Lab.
AN INTEGRAL EQUATION FOR SCATTERING AMPLITUDES
Marvin L. Goldberger, G. F. Chew (Calif. Univ., Berkeley. Lawrence Radiation Lab.), and Francis E. Low (MIT, Cambridge) Jan. 1969 7 p refs
(Contract AF 49(638)-1545)
(AD-686370; AFOSR-69-1011TR) Avail: CFSTI CSCL 20/8

The paper outlines a dynamical scheme for studying Regge behavior of scattering amplitudes. It is based on unitarity and the concept of short-range momentum-space correlations in high-energy processes. Author (TAB)

N69-31486# Kernforschungsanlage Juelich (West Germany). Institut fuer Festoerper- und Neutronenphysik.
SPIN WAVES IN SOLID ORTHO HYDROGEN [DREHIMPULSWELLEN IN FESTEM ORTHOWASSERSTOFF]
Franz-Georg Mertens Oct. 1968 136 p refs In GERMAN
(Jul-564-FN) Avail: CFSTI

In an analogy with the spin wave theory, this study deals with the lowest excited spin levels of solid ortho hydrogen and with the resulting changes in the orientation of the angular impulses of the molecules, which progress in the form of waves in the crystal. The interacting forces between two hydrogen molecules and the ground state of solid ortho hydrogen are calculated and discussed. The secular matrix is reduced for waves extending in specific directions. A numerical method is used for the direct determination of the eigenvalues of the secular matrix for the case of any given wave vector. The spectrum of the spin waves, the interactions between spin waves and lattice vibrations, and experimental possibilities for the excitation of spin waves by neutron diffraction are examined. Transl. by K.W.

N69-31489# Texas Nuclear Corp., Austin.
X-RAY ANALYSIS USING RADIOISOTOPE SOURCES Final Report
J. R. Rhodes Oak Ridge, Tenn. AEC 25 Sep. 1968 127 p refs
(Contract AT(40-1)-3224)
(ORO-3224-14) Avail: CFSTI

Studies from 1964 to 1966 on characteristic X-ray excitation techniques for light elements are reviewed. Later work (1966 to 1968) including the development of a portable radioisotope X-ray analyzer and its field evaluation for some 50 different determinations is examined. Research into heterogeneity effects and into factors leading to improved sensitivity in X-ray fluorescence analysis was conducted and a new measurement of the energy of the 88 keV ^{109}Cd gamma ray was made. Author (NSA)

N69-31509# Mound Lab., Miamisburg, Ohio.
STABLE GASEOUS ISOTOPE SEPARATION AND PURIFICATION, OCTOBER–DECEMBER 1968
7 Apr. 1969 61 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1530) Avail: CFSTI

Research progress is reported on carbon isotope separation, stable gaseous isotope separation, thermal diffusion, and low-temperature processes. NSA

N69-31511# Texas A&M Univ., College Station.
ON-LINE ALPHA AND PROTON DECAY SPECTROMETRY Progress Report, 1968–1969
Ronald D. Macfarlane 15 Jan. 1969 31 p refs
(Contract AT(40-1)-3820)
(ORO-3820-1) Avail: CFSTI

The β-delayed α decay of ^{24}Al, ^{8}Li, ^{12}N, and ^{20}Na was investigated. An unsuccessful search for ^{100}Te was conducted by α spectrometry; an α spectrum for ^{107}Te was obtained. The α decay of ^{216}Ac, ^{218}Ra, ^{217}Ra, ^{217}Th, and ^{221}Th was observed; α energies and half-lives were determined. Alpha spectra of products produced in the evaporation of an ^{221}Ac compound nucleus were recorded. A helium gas flow system for the collection of recoil activities was developed. NSA

N69-31521# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Rutherford High Energy Lab.
MAGNETIC SPECTROMETERS FOR HIGH RIGIDITY PARTICLES IN NUCLEAR STRUCTURE PHYSICS
P. A. Reeve Sep. 1968 127 p refs
(RHEL/R-169) Avail: HMSO 15s

A comprehensive review is given of the design, performance and instrumentation of magnetic spectrometers used with charged particles having momenta greater than 10 MeV/c. Author (NSA)

N69-31524# California Univ., Berkeley. Lawrence Radiation Lab.
BEVATRON OPERATION AND DEVELOPMENT, APRIL–JUNE 1968
Kenneth C. Crebbin and Robert Frias 17 Jan. 1969 16 p refs
(Contract W-7405-ENG-48)
(UCRL-18482) Avail: CFSTI

The beam was on for 78.3% of the scheduled operating time and the Bevatron accelerated 1.9×10^{18} protons. Three primary experiments completed data taking this quarter. The final target areas in the new dual-channel external proton beam facility were brought into operation. Operation of the new facility and the beam-switching modes are discussed. During a shutdown in May, measurements were made of the magnetic field of the Bevatron. Data were collected using a PDP-8 computer and associated hardware. The speed change of the main motor generators during pulsing was again reduced to minimize damage to the generator poles from cyclic loading. This reduced the flattop length from the original 1000 to 500 msec. A new mode of flattop pulsing is under study to reduce the large generator speed change during flattop and to allow us to run long flattops without cyclic damage to the generator poles. Author (NSA)

N69-31543# Atomic Energy Board, Pretoria (South Africa).
TRANSMIT: A COMPUTER PROGRAM TO EVALUATE A MULTI-ELECTRODE ELECTRON GUN
P. C. Haarhoff, G. J. Krige, and S. M. Gordon Nov. 1968 67 p refs
(PEL-184) Avail: AEC Depository Libraries

A computer program, based on a model of a multi-electrode electron gun, suitable for theoretical studies of Retarding Potential Difference (RPD) guns is described. The effect of the spiralling motion of electrons and of the spread in their initial energy on the properties of electron guns is fully taken into account, assuming homogeneous electrical fields between slits and negligible space charge effects. Examples of the application of the program are given. Author (NSA)

N69-31545# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Rutherford High Energy Lab.
NIMROD OPERATION AND DEVELOPMENT Quarterly Report, 1 Apr.–30 Jun. 1968
D. E. Gray, ed. Sep. 1968 20 p refs
(RHEL/R-172) Avail: HMSO 3s 6d

The Nimrod beam was on for high energy physics research for 86% of H.E.P. scheduled operating time. Twelve experiments were continued, and two were commenced in the period under review. Some experimental work on a resonant extraction system for Nimrod is discussed. Radiation survey measurements associated with both of Nimrod's extracted proton beams are given. Radiation dosimetry studies of the integrated absorbed dose of the Nimrod inner vacuum vessel indicate a decreased rate of dose accumulation when the extracted beam mode of operation is employed, as against the scattered-out beam mode. Author (NSA)

N69-31546# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Rutherford High Energy Lab.
A RESONANT EXTRACTION SYSTEM FOR NIMROD
M. R. Harold Nov. 1968 22 p refs
(RHEL/R-173) Avail: HMSO 4s 6d

Using the computer program NIMDYN, beam behavior under resonant conditions was studied and the properties required of the extraction magnets determined. Particular attention was given to the method for causing particles of all betatron amplitudes to leave the stable region in such a way as to result in a small emittance at the beginning of the external transport system. It is shown that there is a choice of methods of spilling the beam, each resulting in different extracted beam characteristics, but all of which would lead to a much higher extraction efficiency than that of the Piccioni system in present use. Author (NSA)

N69-31547# Atomic Energy Commission, Oak Ridge, Tenn. Div. of Technical Information Extension.
BIBLIOGRAPHIES OF ATOMIC ENERGY LITERATURE, ISSUED OR IN PROGRESS DURING THE PERIOD JANUARY–FEBRUARY 1969
[1969] 10 p refs
(TID-3751) Avail: CFSTI

A list of United States Atomic Energy Commission sponsored bibliographies issued or in the pre-publication stage during the period, January through February 1969, is presented. The list is one of a series available as a report and is intended as a source work for less current bibliographies and to prevent duplication of scientific effort. Topics covered are plasma physics, aerospace medicine, radiation effects, radiation power economics, etc. An index of depositories and depository libraries for USAEC reports, and an index of the report number of each bibliography is also included. M.H.E.

N69-31552# Oak Ridge National Lab., Tenn.
INTENSIFYING SCREENS FOR RADIOGRAPHY WITH ENERGIES BETWEEN 70 AND 140 KILOVOLTS CONSTANT POTENTIAL
R. R. Wamorkar and R. W. McClung Mar. 1969 25 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2488) Avail: CFSTI

Lead oxide screens 0.001 in. thick were investigated to determine their usefulness as radiographic image intensifiers at X-ray energies below the normally accepted limit of about 120 kVcp. Radiographs were made of a stainless steel step wedge (thicknesses from 0.020 to 0.200 in.) with X-rays ranging in energy from 65 to 140 kVcp and with varying exposure times. With no specimen on the X-ray film, the attenuation of the X-rays exceeded any intensification effect. With a specimen of any thickness there was increased film density with the use of the lead oxide screens. There appeared to be unexplained fluctuations of the intensification factor as a function of the film density that was achieved. Author (NSA)

N69-31564# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
STATEMENT OF PROBLEMS OF STATISTICAL PHYSICS
A. S. Shvarts 1968 44 p refs In RUSSIAN Presented at the Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev
(ITF-68-57; CONF-680453-1) Avail: AEC Depository Libraries

The representation of states of the quantum-mechanical system by positive functionals defined on an algebra of observables is investigated. It is shown that, making use of this representation, one can state the problem of determination of the equilibrium state just in an infinite volume. The formalism suggested is used to consider some models of statistical physics. Author (NSA)

N69-31568# North Carolina Univ., Chapel Hill.
THE BORN APPROXIMATION IN COLLISIONS OF HEAVY CHARGED PARTICLES WITH INNER SHELL ELECTRONS
George James Basbas (Ph.D. Thesis) 1968 41 p refs Sponsored in part by AEC
(ORO-2408-9) Avail: CFSTI

Numerical calculations in the Born approximation are made for K-shell ionization by heavy-charged-particle impact. The purpose of the calculations is to assess the importance of nuclear Coulomb repulsion and the description of the atomic screening in estimating ionization cross sections. Comparisons of the T-matrix and excitation function are made with the Bethe plane-wave Born approximation results in the context of simplifying approximations employed to facilitate computations. A Coulomb wave function description for the heavy charged particle gives a significantly lower result than the corresponding Bethe plane-wave Born approximation result. A Hartree–Fock–Slater description of the atomic electrons causes a slight increase over results based on the screened hydrogenic atomic description used in the Bethe plane-wave Born approximation. Sample calculations are for 60- to 1600-keV protons on copper. Author (NSA)

N69-31569# Brookhaven National Lab., Upton, N.Y.
SOME COMMENTS ON PSEUDO-MODE SOLUTIONS OF THE INITIAL-VALUE PROBLEM OBTAINED BY ANALYTIC CONTINUATION: THERMAL AND FAST SYSTEMS
J. Doming, B. Nicolaenko, and J. K. Thurber Jan. 1969 34 p refs Presented at the Conf. on Transport Theory, Blacksburg, Va., Jan. 1969 Sponsored by AEC
(BNL-13421; CONF-690108-1) Avail: CFSTI

Some of the basic concepts of the method of analytic continuation are presented in detail in the initial discussion of the thermal pulsed-neutron problem. Using analytic continuation, the fundamental root (which bifurcates) of the dispersion relation onto non-physical Riemann sheets is followed. Knowing the locations of these bifurcated roots allows the calculation by saddle point methods of the dominant behavior of the unstable decay state (pseudomode). After reviewing the details of establishing the dispersion relation in terms of the Green's function of an auxiliary slowing-down operator, a solution for that Green's function is presented, and the motion of the root of the resulting dispersion relation on the physical and nonphysical sheets is examined. Again, as in the thermal problem, nearby roots (the fundamental root n-furcates) on the sheets adjacent to the physical one allow the calculation of the dominant pseudo-mode decay behavior. Author (NSA)

N69-31620# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Rutherford High Energy Lab.
COMPUTER STUDY OF VERTICAL BEAM BLOW-UP DURING RESONANT EJECTION FROM NIMROD
J. Ranft and T. J. Stevens Dec. 1968 18 p refs
(RHEL/R-174) Avail: HMSO 3s

Computer studies of beam behavior in the vertical phase plane are reported, and the coupling resonances present in Nimrod near the radial 2/3 resonance are studied. These coupling resonances result in a vertical beam growth during resonant ejection, which is smaller than 10% for systems employing only continuous field perturbations, but which could be as large as 30% if lumped perturbation magnets were used to induce the wanted radial 2/3 resonance. Author (NSA)

N69-31653# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
MASS ATTENUATION AND MASS ENERGY ABSORPTION COEFFICIENTS FOR 10 keV TO 10 MeV PHOTONS [COEFFICIENTS D'ATTENUATION MASSIQUE ET D'ABSORPTION MASSIQUE EN ENERGIE POUR LES PHOTONS DE 10 keV A 10 MeV]
Henri Joffre and Lucien Pages Dec. 1968 59 p refs In FRENCH
(CEA-R-3655) Avail: AEC Depository Libraries

Mass attenuation coefficients and mass energy absorption coefficients for some elements and mixtures necessary for the study of tissue equivalent materials are given for photons in the energy range 10 keV to 10 MeV. After short definitions of the two coefficients, a compilation of these coefficients as a function of energy is given for simple elements, for certain mineral compounds, organic compounds, gases and particularly for soft tissues. Author (NSA)

N69-31669# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
THREE-QUASIPARTICLE ISOMER IN SM 143
W. Neubert, K. Alexander, H. Rotter, S. Chojnacki, and Ch. Droste 1969 30 p refs *In* RUSSIAN
(JINR-P6-4276) Avail: AEC Depository Libraries

In the reactions $^{120}Te(^{22}Ne,5n)^{143}Sm$, $^{128}Te(^{22}Ne,7n)^{143}Sm$, and $^{130}Te(^{20}Ne,7n)^{143}Sm$ a highly excited isomeric state with a half-life of 35 ± 8 ms was found. The atomic number was assigned by means of the conversion electron spectrum from the measured difference of K and L electron binding energies. The mass number follows from excitation function measurements. The following γ rays were observed: 51 keV, 75 keV(M1), 180 keV(E1), 209 keV(E3-isomeric transition), 1574 keV, 1703 keV, and 1829 keV. The γ-ray spectrum and the isomeric cross-section ratios measured for the reactions $^{124}Te(^{22}Ne,3n)$, $^{126}Te(^{22}Ne,5n)$, $^{128}Te(^{22}Ne,7n)$, and $^{130}Te(^{20}Ne,7n)$ are in agreement with the fact that the 35-ms isomer decays to the first isomeric level in ^{143}Sm. The 35-ms isomeric state has an excitation energy of 2793 keV. Several three-quasiparticle configurations which could explain the existence of the isomeric state are discussed. Author (NSA)

N69-31675# Oak Ridge National Lab., Tenn.
CALCULATION OF THE RESIDUAL PHOTON DOSE RATE AROUND HIGH-ENERGY PROTON ACCELERATORS
T. W. Armstrong and R. G. Alsmiller, Jr. 10 Feb. 1969 41 p refs
(ORNL-TM-2498) Avail: CFSTI

Calculations were carried out to determine the time dependence of the residual photon dose rate around a high-energy proton accelerator. The development of the nucleon–meson cascade, the residual nuclei production, and the photon transport are calculated, using Monte Carlo methods. Proton beams of 3 and 200 GeV and shields in the form of infinite cylinders of iron and heavy concrete are considered. Although the 3-GeV calculations are carried out with some exactitude, the results for the 200-GeV case must be considered very approximate since the energy and angular distributions of the products from nuclear interactions in this energy range are not well known. Author (NSA)

N69-31689# Princeton-Pennsylvania Accelerator, Princeton, N.J.
INTERACTIONS OF 290 MeV/c POSITIVE PIONS WITH DEUTERIUM
James H. Norem 5 Dec. 1968 81 p refs
(Contract AT(30-1)-2137)
(PPAR-7) Avail: CFSTI

The total cross section and the differential cross section of the reactions $\pi^+ d \rightarrow \pi^+ d$, $\pi^+ d \rightarrow \pi^+ + p + n$, $\pi^+ d \rightarrow \pi^0 + p + p$, $\pi^+ d \rightarrow \gamma + p + p$, and $\pi^+ d \rightarrow p + p$ were measured using 65,000 pictures of 290-MeV/c π^+ in a 15" bubble chamber. The elastic, inelastic, and charge exchange scattering data are more complete and more accurate than any previously existing at or near this energy. Events were identified on the basis of range, ionization, coplanarity, and angular correlations of tracks. The cross section for radiative absorption (inverse photoproduction) was found to be consistent with predictions made on the basis of time reversal. Assuming reciprocity, the cross section for $\pi^+ d \rightarrow pp$ was compared with other measurements of $\sigma(pp \rightarrow \pi^+ d)$ and was found to be consistent. The spectator momentum spectrum was measured for the charge exchange scattering and was found to be consistent with the simple Hulthen wave function. Author (NSA)

N69-31690# Washington Univ., Seattle. Dept. of Physics.
SPIN FLIP IN THE INELASTIC SCATTERING OF PROTONS
W. A. Kolasinski, J. Eenmaa, F. H. Schmidt, H. Sherif, and J. R. Tesmer 1968 32 p refs Supported in part by AEC
(RLO-1388-94) Avail: CFSTI

Proton spin-flip probabilities and differential scattering inelastic cross sections were measured over a large angular region for the following 2^+ excitations: 4.44 MeV in ^{12}C at 12, 13, 14, 15, and 20 MeV; 1.45 MeV in ^{58}Ni at 9.25, 10.46, 15 and 20 MeV; 1.33 MeV in ^{60}Ni at 10.5 and 14 MeV; and 1.34 MeV in ^{64}Ni at 10.5 and 14 MeV. The results were analyzed in the distorted-waves Born approximation, with collective model form factors derived from the optical model potential. The deformed spin-dependent part of the coupling potential was of the full Thomas form, and the data are best described when $\beta^{SO}_2 > \beta_2$. Good fits are obtained for elastic polarization data (obtained elsewhere) when the depth of the spin-orbit potential is determined from spin-flip probability measurements. Author (NSA)

N69-31707# Hungarian Academy of Sciences, Budapest.
NEUTRON TRANSMISSION THROUGH MULTILAYER SHIELDS
S. Makra and P. Vertes 18 Nov. 1968 12 p refs
(NP-17789) Avail: AEC Depository Libraries

A method for evaluating the neutron spectra as modified by shielding is presented. Some consequences of the changes and complexity of the modified spectra are discussed. The calculations are compared with measured data. Spectra of neutrons transmitted through shields of different materials and different thicknesses are calculated by the code TRAM. This code is based on the formalism of an albedo method and calculates a large number of neutron spectra in a relatively short time. Spectra and fractions of slow, intermediate and fast energy groups are evaluated as a function of shield thickness. The materials considered are water, concrete, iron, iron–concrete mixtures, and lead. The input spectra were both the fission spectrum and the fission spectrum after penetration through water layers of various thicknesses. NSA

N69-31723# Oak Ridge National Lab., Tenn.
EXPERIMENTAL STUDIES OF ELECTRON-PHOTON CASCADES IN LEAD-SCINTILLATOR SYSTEMS FOR PRIMARY ENERGIES BETWEEN 100 AND 440 MeV
Klaus-Peter Bauermann and Gerd Wibberenz [1968] 22 p refs Transl. into ENGLISH from Z. Phys. (Berlin), no. 206, 1967 p 247–265
(ORNL-tr-1892) Avail: CFSTI

Showers generated by electrons of 200 and 440 MeV energy in single lead plates of 2, 5, and 10 radiation lengths are measured in scintillator material (NE 102 A) varying between 1.24 and 10.5 g/cm^2. The mean energy deposited in a scintillator is derived from Nagel's Monte-Carlo calculations. The photon contribution $n\gamma$ to the total pulseheight is of the order 15% near shower maximum t_{max}. It dominates the electron contribution n_e in a 3 cm thick scintillator for shower depths $t \geq 4.2 \cdot t_{max}$. The slope of the total ionization $n_e + n\gamma$ behind the shower maximum can be approximated by $n(t) \approx \exp(-0.264\ t)$. The shower absorption in scintillator depends on the thickness x (g/cm^2) as $\exp(-0.068\ x)$. An arrangement of counter trays, scintillators and lead plates is calibrated with electrons between 100 and 440 MeV energy. A suitably defined track-length S is shown to give minimum error in energy measurement and to depend linearly on electron energy. Author (NSA)

N69-31725# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf.
MEASUREMENT OF THE ANGULAR CORRELATION COEFFICIENT IN NEUTRON DECAY Final Scientific Report, 1 Feb. 1968–31 Jan. 1969
Peter Weinzierl and Paul Helmut 19 Feb. 1969 12 p refs
(Contract AF 61(052)-857)
(AD-685789; AFOSR-69-0896TR) Avail: CFSTI CSCL 20/6

The preparatory stages of an experiment to measure the angular correlation constant in a neutron beta decay are described. Neutrons will decay in the central part (next to the core) of a tangential beam tube of the ASTRA reactor. The decay protons fly over a distance of about 4 m into a spherical condenser electrostatic spectrometer and will finally be accelerated and counted by means of a coincidence ion-electron converter. A proton source at the other extreme of the beam tube will inject a precisely controlled beam of simulated decay protons at regular intervals, so that the constancy of transmission and of detection efficiency can be monitored in between spectrum measurements. The experiment requires low-background counting and the maintenance of low magnetic fields, low pressure and low electric fields under intense gamma and neutron irradiation. In preliminary investigations, the effect of neutron irradiation on soft magnetic materials, outgassing rates under reactor irradiation, and the effectiveness of magnetic shielding have been investigated. The shape of the proton spectrum, the influence of magnetic and electric fields upon the proton transmission, and corrections due to motion of the decay neutrons, and to finite spectrometer resolution, have been calculated. Most of the apparatus has been built. TAB

N69-31727# Australian National Univ., Canberra. Research School of Physical Sciences.
ANGULAR-CORRELATION STUDIES OF THE REACTION Mg-24 (α p γ) Al-27
K. W. Carter, R. V. Elliott, D. C. Kean, and R. H. Spear [1968] 24 p refs
(ANU-P-428) Avail: AEC Depository Libraries

The 3.68-, 3.95-, 4.05-, and 4.58-MeV levels of ^{27}Al were studied via angular correlation measurements of the reaction $^{24}Mg(\alpha,p\gamma)^{27}Al$. The results are used in conjunction with previous information on lifetimes and branching ratios to impose limitations on possible spins, parities, and multipole mixing ratios. New information on the gamma-ray decay scheme of the 4.58-MeV level is presented. Author (NSA)

N69-31729# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR).
DEPOSITION OF RADIOACTIVE DUST AND ITS ELIMINATION FROM THE ATMOSPHERE BY PRECIPITATION
K. P. Makhon'ko 1968 42 p refs In RUSSIAN
(A-AC-92/G/L-1262) Avail: AEC Depository Libraries

Literature on radioactive fallout and mechanisms affecting its removal from the atmosphere is briefly reviewed. Factors contributing to fallout levels include natural products of radon and thoron decay from the earth's surface, radioactive waste from industrial sources, and particles from nuclear explosions. The removal of radioactive fallout from the atmosphere is accomplished by gravitational forces, turbulent transfer, and precipitation scavenging. The influence of each of these factors is discussed with emphasis on precipitation scavenging as an atmospheric self-purification process. NSA

N69-31730# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.

ATOMIC AND MOLECULAR SCATTERING FROM SOLIDS-2 COMPARISON OF CLASSICAL SCATTERING MODELS IN RELATION TO EXPERIMENT

J. Doyle McClure Mar. 1969 38 p refs Submitted for publication

(DI-82-0806) Avail: Issuing Activity

Characteristics of a classical two dimensional (2D) model of atomic scattering from finite temperature, elastic solids are compared to similar characteristics of quasi-1D scattering models in the light of pertinent experimental scattering studies of rare gas atomic beams on metals. The 2D finite-range interaction field (denoted 2D FRI) is composed of additive Lennard–Jones pairwise potentials. Compared scattering characteristics include beam directivity and position as well as variation of mean tangential/normal momentum with scattering angle. Dominant effects of finite collision time, as determined by 2D FRI, cast doubt on previous interpretation that observed differences in lobe position for effusive incident beams of different rare gases scattered from a particular hot metal crystal result from simple mass ratio effects. Effects of finite collision time are also invoked to interpret recent experimental findings on differences in lobe position for a given rare gas beam scattered from different hot metal crystals. Author

N69-31732# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR). Fiziko-Energeticheskii Institut.

THE DOUBLE SPECTROMETER OF SLOW NEUTRONS DIN-1 [DVOINOI SPEKTROMETR MEDLENNYKH NEITRONOV DIN-1]

V. G. Liforov, A. G. Novikov, V. Z. Nozik, V. V. Orlov, V. A. Parfenov et al 1968 27 p refs In RUSSIAN

(FEI-129) Avail: AEC Depository Libraries

A physical description is given of the DIN-1 double spectrometer at the IBR-1 reactor at Dubna. The basic characteristics of the spectrometer and the intensity of the monochromatic neutrons are reported. On the basis of measurements made with the spectrometer, it was concluded that the IBR-1 fast pulse reactor is an effective source of slow neutrons for the study of the physics of condensed states. A series of refinements made in 1968 significantly improved the characteristics of the spectrometer. The feasibility of the design DIN-2 on the reactor IBR-2 permits the resolution to be greatly improved. NSA

N69-31734# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

CRITICAL EXAMINATION OF α EQUALS σ_c/σ_f VALUES FOR ^{239}Pu ABOVE 1 keV AND EXPERIMENTS FOR IMPROVING THESE VALUES

Jean-Yves Barre, Jean-Pierre l'Heriteau, and Pierre Ribon Sep. 1968 74 p refs In FRENCH

(CEA-N-989; EANDC(EUR)-111) Avail: AEC Depository Libraries

A critical examination was made of previously reported values of α ^{239}Pu above 1 keV, and experiments were performed to improve the data on these values. The microscopic measurements made (irradiation, determination beginning with σ_c and σ_f direct measurement of α, and measurement of η) are described in detail and the results obtained are reported. Three methods (ratio of danger coefficients, K_∞ unity, and "Barraka") were used to measure macroscopically the values of the $\overline{\alpha}$ parameter of ^{239}Pu on critical assemblies. The effect of possible variations of the α parameter (multiplication coefficient and breeding rate) on the parameters of the fast neutron reactor Phenix was studied. In particular, the Phenix parameters obtained with the α values obtained in this study are examined. The experiments which can improve the knowledge of α are discussed. Author (NSA)

N69-31735# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.

ABOUT MINIMAX PRINCIPLE FOR SOME MODEL PROBLEMS OF STATISTICAL PHYSICS

N. N. Bogolubov, Jr. 1968 11 p refs Presented at the 2d Conf. on Statist. and Phys. Kinet., Kiev, Sep. 1968

(ITF-68-81; CONF-680949-1) Avail: AEC Depository Libraries

A method for investigation of the model problems of general type containing at once the terms with positive and negative pair four-fermion interaction is proposed. An asymptotically exact solution for such problems under sufficiently general conditions is presented. The methodics under development led to minimax principle for the model problems with pair four-fermion interaction. Author (NSA)

N69-31737# North Carolina Univ., Chapel Hill.

ATOMIC PERTURBATIONS IN NUCLEAR REACTIONS

Lawrence Arnold Coleman (Ph.D. Thesis) 1969 74 p refs Supported by AEC

(ORO-2408-10) Avail: CFSTI

Single-atom processes are studied in which the reacting projectile interacts with the atomic electrons, causing ionization. This ionization produces changes in the resonance line shape so that isolated nuclear resonances no longer have the simple, symmetric, Breit–Wigner form. A simplified model of the atom is assumed in which there is only one excited state, and the electron-projectile potential is adjusted so that this single state can approximately represent the infinite number of real states. The criterion used requires that the total excitation probability for the model be equal to that for the particular atomic shell being considered. The R-matrix theory of nuclear reactions forms the basis for the calculation. The two-state model of the atom allows the Schroedinger equation to be expressed as a pair of coupled differential equations with the elimination of the electronic coordinates. These equations permit the appropriate definition of internal and external states as required by the R-matrix theory. The theory is then developed for an isolated nuclear resonance. Author (NSA)

N69-31744# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.

ABOUT DESCRIPTIONS OF QUANTUM-MECHANICAL SYSTEM IN CASE OF INCORRECTNESS OF SCHROEDINGER'S REPRESENTATION

V. P. Oleinik 1968 20 p refs In RUSSIAN; ENGLISH summary Presented at 2nd Conf. on Statist. and Phys. Kinet., Kiev, Sep. 1968

(ITF-68-88; CONF-680949-4) Avail: AEC Depository Libraries

The description by means of Green's function method of the quantum-mechanical system for which Schrödinger's representation appears to be invalid is proposed. The pattern of the phase transition considered previously in electron gas in the field of an electromagnetic wave and homogeneous magnetic field is discussed. It is shown that relativistic and calibration invariances and the principle of microscopic causality being carried out, the relation of continuity for current is satisfied. The question about determination of probabilities of scattering processes is considered. The functional

of unified probability is introduced by the help of which the probability of scattering of quanta of a coherent radiation on an electron in the homogeneous magnetic field is calculated. It should be noticed that the results obtained may be used to check the theory experimentally. Author (NSA)

N69-31753# Gosudarstvenny Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Institut Fiziki Vysokikh Energii.
INTERMEDIATE STATES IN THE t-CHANNEL OF THE REACTION AND RADIUS OF STRONG INTERACTIONS
A. A. Logunov, M. A. Mestvirishvili 1968 15 p refs In RUSSIAN
(IFVE-STF-68-54-K) Avail: AEC Depository Libraries

It is shown that the connection between the effective radius of the interaction and the position of the singularities nearest to the origin in the t- and u-channels of the reaction makes it possible to estimate the value of the differential cross-section of a number of processes of strong interactions. Author (NSA)

N69-31755# European Organization for Nuclear Research, Geneva (Switzerland).
MASS SPECTROSCOPY OF HEAVY BOSONS AND SPIN-PARITY ANALYSIS WITH A NEW INSTRUMENT
Peter Schuebelin (Ph.D. Thesis—Bern Univ.) 12 Dec. 1967 181 p refs
(NP-17812) Avail: AEC Depository Libraries

The boson mass spectrum was investigated in the reaction $\pi^- + p \rightarrow p + X^-$ in the region $0.5 < M_X < 2.5$ GeV by means of the CERN Missing Mass Spectrometer, using the Jacobian peak method. Three new heavy bosons referred to as S, T, and U mesons (M_S = 1929 MeV, M_T = 2195 MeV, M_U = 2382 MeV) were found. Their experimental widths are equal to the experimental resolution, of the order of 25 MeV. The mass region of the R meson has been investigated with large statistics. The R meson is split into three, perhaps four peaks ($MR1$ = 1630 MeV, M_{R2} = 1700 MeV, M_{R3} = 1748 MeV, M_{R4} = 1830 MeV) each of them with width equal to the experimental resolution. The A_2 meson, first observed in bubble chambers, was measured with high statistics. It was found to be split into two peaks of equal width and height in all samples of good experimental resolution (16 to 18 MeV), whilst no splitting was seen in samples with larger resolution. In order to determine the still controversial spin-parity of the A_2 meson, a novel additional instrument to the Missing Mass Spectrometer has been developed. Author (NSA)

N69-31760# Oak Ridge National Lab., Tenn.
NEUTRON FISSION AND CAPTURE CROSS-SECTION MEASUREMENTS FOR U-233 IN THE ENERGY REGION 0.02 to 1 E-V
L. W. Weston, R. Gwin, G. De Saussure, R. W. Ingle, J. H. Todd et al 1 Feb. 1969 26 p refs
(ORNL-TM-2353) Avail: CFSTI

The relative neutron capture and fission cross section in the neutron energy range 0.02 to 1.0 eV were measured simultaneously. The data are normalized by means of the previously reported total cross section. The technique used was passing a pulsed neutron beam through a ^{233}U fission chamber placed at the center of a large liquid scintillator. The prompt neutron capture gamma rays were detected only in the liquid scintillator, whereas a fission event was characterized by coincident signals from the liquid scintillator and fission chamber. This technique provides a new method of obtaining eta in this neutron energy range which is not subject to the same type errors as a direct measurement. Comparisons with previously published data are given. Author (NSA)

N69-31770# Joint Inst. for Nuclear Research, Dubna (USSR).
BUILDUP OF THE LOW-ENERGY RADIATION IN THE ACCELERATOR SHIELDING
B. S. Sychev 1969 36 p refs *In* RUSSIAN
(JINR-P16-4304) Avail: AEC Depository Libraries

Analytical expressions for the spatial distributions of the neutron energy spectra (E < 20 MeV) and the γ-radiation dosage in the proton accelerator shielding are presented. Author (NSA)

N69-31774# Australia National Univ., Canberra. Research School of Physical Sciences.
ENERGY DEPENDENCE OF THE O 16 (He 3, He 3) O 16 and the O 16 (He 3, α) O 16 ANGULAR DISTRIBUTIONS IN THE RANGE 9.8 to 11.7 MeV
K. H. Bray and J. Nurzynski [1968] 26 p refs
(ANU-P/433) Avail: AEC Depository Libraries

Angular distributions of the $^{16}O(^3He,^3He)^{16}O$ and the $^{16}O(^3He,\alpha_0)^{16}O$ reactions were measured at the incident ^3He particle energies of 9.802, 9.955, 10.210, 10.313, 10.465, 10.720, 11.229, and 11.738 MeV. While the distributions for the elastic scattering are similar at all energies, the shape of the differential cross section for the $^{16}O(^3He,\alpha_0)^{16}O$ reaction exhibits a strong energy dependence at angles $\theta \geq 50°$. At forward angles the $(^3He,\alpha)$ distributions display some characteristics of direct pick-up transition, i.e., a rise in the differential cross section and a regular diffraction structure. The data were analyzed in terms of the optical model and distorted-wave Born approximation theory. Author (NSA)

N69-31776# California Univ., Berkeley. Lawrence Radiation Lab.
NEGATIVE KAON PROTON INTERACTIONS AROUND 1 GeV/c AND THE Y1815 RESONANCE
Jack Yacoub S. Sahouria (Ph.D. Thesis) Jan. 1969 50 p
(Contract W-7405-eng-48)
(UCRL-18624) Avail: CFSTI

The reaction $K^-p \rightarrow \Delta\pi^+\pi^-$ in the center-of-mass energy range 1700 to 1850 MeV is analyzed under the assumption that the reaction proceeds mainly by the production of the intermediate state $Y^*_1(1385)$. A good fit to the production and decay angular distributions and the mass plots of the $Y^*_1(1385)$ and the lambda polarization is obtained, showing the well known resonances $Y^*_1(1770)$ and the $Y^*_0(1820)$. This fit also requires a possibly resonating state with iso-spin, spin and parity $O(3/2^+)$ and mass at or below 1700 MeV which is the low end of the energy range in this experiment. Author (NSA)

N69-31778# Bordeaux Univ. (France). Faculte des Sciences.
CONTRIBUTION TO THE STUDY OF THE INTERACTION OF FAST NEUTRONS WITH 1p, 2s, 1d NUCLEI
Jacques Roturier (Ph.D. Thesis) 1968 228 p refs In FRENCH
(NP-17794) Avail: AEC Depository Libraries

Elastically and inelastically scattered neutrons and γ rays that result from the interaction of fast neutrons with light nuclei (1p, 2s–1d) were studied. The fast neutrons were produced with the d + T reactions and were studied with a time-of-flight spectrometer. The elastic scattering of neutrons from Be, Si and K was measured. While analyzing the results, the other available data were taken into account. These data were analyzed using Dar's diffraction model, and an interpretation is proposed for the parameter deduced. The non-local potential optical model was used to calculate cross sections; and results are presented for Be, Al, Si, K, and Ca. There is an indication of compound elastic contribution in the case of Be which was studied with the Hauser-Feshbach theory. The inelastic scattering data for $^9Be(n,n')^9Be$ (Q = −2.43 MeV) and $^{12}C(n,n')^{12}C$ (Q = −4.43 MeV) give good fit with the values obtained from the coupled-channel theory of Tamura. Author (NSA)

N69-31779# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
STUDY OF THE JOINT RESONANCE PRODUCTION IN 4-PRONG POSITIVE PION–PROTON INTERACTIONS AT 2.34 GeV/c
N. Angelov, I. M. Gramenitskii, Kh. Kanazirski, P. Kerschev, A. M. Moiseev et al 1969 16 p refs In RUSSIAN
(JINR-P1-4330) Avail: AEC Depository Libraries

The cross sections for the joint production of $N^*\rho$ and $N^*\omega^0$ resonances in π^+-p interactions at 2.34 GeV/c are given. The dependence of the elements of single-vertex spin density matrix on the four-dimensional transferred momentum is determined. The experimental data are compared with the calculations by the model of one-particle exchange with absorption. Author (NSA)

N69-31784# Stanford Linear Accelerator Center, Calif.
PHOTOPRODUCTION OF NEUTRAL VECTOR ρ AND ϕ MESONS IN THE FORWARD DIRECTION AT VARIOUS ATOMIC NUCLEI [PHOTOPRODUKTION DER NEUTRALEN VEKTOR-MESONEN ρ AND ϕ IN VORWAERTSRICHTUNG AN VERSCHIEDENEN ATOMKERNEN]
Ulrich Becker (Ph.D. Thesis—Hamburg Univ., 1968) [1969] 118 p refs Transl. into ENGLISH from German thesis
(SLAC-Trans-92) Avail: CFSTI

The reactions $\gamma+A \rightarrow \rho^0+A$ and $\gamma+A \rightarrow \phi+A$ were investigated at γ energies of 2.7 to 4.5 GeV and 4.0 to 6.2 GeV in the region of small angles, $\delta < 6°$, with respect to the γ beam on targets of Be, C, Al, Cu, Ag, and Pb. Measurements at various momenta showed that the effective total cross section is constant, in contradiction with the one-pion-exchange model. On the other hand, the data were described quite well by the diffraction-dissociation model. The mass and width of the ρ^0 meson were found to be 765 ± 5 and 130 ± 5 MeV/c^2, respectively. The effective total cross sections for the interactions ρ^0 + N and ϕ + N were determined using the model of Drell and Trefil; the results are in agreement with the predictions of the quark model. The coupling coefficients of the vector dominance model were determined using the effective cross sections. The ρ^0 coupling constant is in good agreement with values obtained by other methods. NSA

N69-31789# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
INVESTIGATION OF ^{144}Gd and ^{145}Gd DECAY: ON THE PECULIARITIES OF THE QUASIPARTICLE $2d_{3/2}$ AND $3s_{1/2}$ LEVELS
R. Arl't, G. Baiev, G. Muziol, L. K. Peker, G. Pfrepper et al 1969 25 p In RUSSIAN
(JINR-P6-4247) Avail: AEC Depository Libraries

A new isotope ^{144}Gd with a half-life of 4.9±0.4 min was found. The endpoint energy of its β^+ spectrum is 3300±400 keV. β^+ and γ spectra of the ^{145}Gd decay were studied, on the basis of which the decay scheme of ^{145}Gd is constructed. This scheme is discussed in the framework of model representations. The location of the quasiparticle $2d_{3/2}$ and $3s_{1/2}$ levels is considered separately. β^+ and γ coincidences were investigated to verify the decay scheme. Author (NSA)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N69-30570 Polytechnic Inst. of Brooklyn, N.Y.
EXPERIMENTS ON RESISTIVE INSTABILITIES IN A TOROIDAL PLASMA
Kenneth Stuart (Ph.D. Thesis) 1968 148 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-16287

The experimental setup consists of a plasma filled ring-shaped container of rectangular cross section, where a discharge is induced by means of an iron cored transformer. The time development of the current distribution in the plasma is determined with the help of a combination of magnetic probes and an image converter camera. Optical spectroscopy is used to calculate the temporal variation of electron number density and temperature. It is found that the plasma forms near the inner cylindrical wall, where the primary winding is located, and moves radially outward as time progresses. The radial speed depends on the mass density and magnetic field associated with the plasma in accordance with the snowplow model. Concurrently with the outward motion a resistive instability develops, which breaks the current sheet into separate rings. Dissert. Abstr.

N69-30592 Vanderbilt Univ., Nashville Tenn.
INTERACTION OF A TRANSVERSE MAGNETIC FIELD
Curtis Williard Parkin (Ph.D. Thesis) 1968 91 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-17988

Induction, transport, and decay of a plasma field, due to a transverse applied dc magnetic fieldplasma flow interaction, are observed. The experiment is conducted using peak bank currents of 65 to 160 kiloamperes and initial pressures of 50 to 1000 microns in argon. Search coils detect induced plasma magnetic-fields (B_p) as large as 590 gauss. The plasma is found to behave qualitatively as an RL circuit as it passes through the applied field. When the plasma leaves the applied field region, the field remaining in the flow decays exponentially. Measured B_p-profiles allow calculation of decay times and magnetic Reynolds numbers (R_m) which agree well with an MHD theory involving assumption of conductivity reduction in the applied field region and blast wave profiles of flow parameters. Analysis in the pure decay region for a range of bank and pressure conditions shows a linear relationship of R_m with flow velocity. Decay times show little variation with flow velocity. This finding emphasizes that the luminous plasma front found in this experiment is not a true shock front since its temperature shows little change with velocity. Dissert. Abstr.

N69-30622*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REFRACTIVE INDEX: PARTICLE DENSITY NONEQUILIBRIUM CESIUM PLASMAS PROBED BY A MULTIFREQUENCY HELIUM-NEON LASER
Richard B. Lancashire Washington Jul. 1969 24 p refs
(NASA-TN-D-5328) Avail: CFSTI CSCL 20I

The refractive index of a nonequilibrium cesium plasma is computed for the free electrons and neutral atoms ($6S_{1/2}$ to $7P_{3/2}$ levels) at laser wavelengths of 0.6328, 1.1523, and 3.3914 μm. Densities of the neutrals were computed using quasi-steady-state solutions to the various level rate equations for typical thermionic diode conditions (initial cesium atom densities from 10^{15} to 10^{17} cm^{-3} and electron temperatures from 1500° to 3000°K). The dominant contributors to the refractive index are the ground-state neutrals and the free electrons. The results indicate the usefulness of the technique to measure local cesium atom densities accurately. Author

N69-30625# Kernforschungsanlage Juelich (West Germany). Institut fuer Plasmaphysik.
WORK REPORTS OF THE THEORETICAL AND EXPERIMENTAL GROUPS FOR 1967 [ARBEITSBERICHTE DER THEORETISCHEN UND EXPERIMENTALLEN GRUPPEN FUER DAS JAHR 1967]

E Geissler, comp. Dec. 1968 78 p refs In GERMAN (Jul-567-PP) Avail: CFSTI

Theoretical and experimental work at the nuclear research facility centered on plasma acceleration methods. Evaluated were plasma pinch and control plasma particle interactions, ionization and pulsation methods, etc. G.G.

N68-30634 Tennessee Univ., Knoxville.

NONLINEAR INTERACTIONS IN QUANTUM PLASMAS

Robert Edward Wilems (Ph.D. Thesis) 1968 165 p

Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-1273

Interactions of photons and fast electrons with plasmons in both bounded and unbounded systems were investigated within the framework of a quantum hydordynamic model for the plasma. Plasmons in both plasmas and plasmas containing structural imperfections were studied. Among the several interactions of photons with perfect plasmas which were examined were radiative damping of plasmons, resonance fluorescent scatter, second harmonic generation, and Raman scatter. The frequency shift of the radiative surface plasmon due to coupling with the radiation field were investigated, and resonance emission from photon stimulated plasmons in imperfect plasmas and "grating" plasmas was also explored. Characteristic energy loss and gain by fast electrons through interaction with the plasmon field were studied. Dissert. Abstr.

N68-30638 Northwestern Univ., Evanston, Ill.

NUMBER DENSITY FLUCTUATIONS IN AN EQUILIBRIUM ELECTRON PLASMA

Buddy Badri Saleeby (Ph.D. Thesis) 1968 68 p

Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 68-1929

A pair of coupled equations governing the evolution of the fluctuations in number density in phase space for an equilibrium electron plasma and valid to second order in the plasma parameter, $\epsilon = 1/n\lambda^3_D$ (so as to include the collisions), is derived in two ways using the Liouville equation applied to a two-time distribution function in γ space, and the Klimontovitch equation which governs the evolution of the exact (classical) number density in phase space. The derived equations which are formally identical to the linarized equations for F and g (obtained from the BBGKY heirarchy) are then treated using a shielding approximation which is a generalization for short times and saptial inhomogeneity of the method leading to the Landau form of the Fokker–Planck equation; the spectral density for the electron number density fluctuations in ordinary space is obtained and collisional corrections to the resonance phenomenon are given. Dissert. Abstr.

N69-30826# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

MEASUREMENT OF WAVE-NUMBER SPECTRA [MESURE DE SPECTRES DE NOMBRES D'ONDE]

F. Perceval, J. C. Bousque, J. Olivain, M. Parisot, and M. Perulli [1968] 14 p refs In FRENCH Presented at Conf. on Plasma Diagn., Culham, Engl., 19 Aug. 1968

(CEA-CONF-1059; CONF-680831-4) Avail: AEC Depository Libraries

In order to measure wave lengths in an ionized medium, an intercorrelation product between the signal collected by a fixed probe and that of a mobile probe is obtained. To determine the different modes constituting signals from several simultaneous propagation modes, an apparatus that makes a Fourier analysis of signals of this type was developed. The apparatus is based on the calculation of the Fourier transform of a signal delivered by an interferometer. The apparatus was tested by calculating the Fourier spectrum of pure sinusoids, mixtures of sinusoids, and damped sinusoids. The apparatus was used to measure the space structure of waves being propagated either in a plasma column or in a double-beam system. NSA

N69-30830# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.

TOPICS IN ELECTROMAGNETIC SCATTERING FROM A RANDOM PLASMA SLAB

Adolf R. Hochstim, Julius L. Jackson, John Jarem, Charles P. Martens, and Marvin Mittleman Jan. 1969 93 p refs

(Contract DAHC15-67-C-0011; ARPA Order 5; Proj. Defender)

(AD-684791; IDA-HQ-68-9165; RP-P-441) Avail: CFSTI CSCL 17/9

This research paper consists of a series of reports treating topics related to the determination of the energy reflected when a plane electromagnetic wave is normally incident upon a random plasma slab. Random functions suitable for use in computer modeling the electron density fluctuations in a plasma slab are described and their statistical properties are derived. Two equivalent methods are given for generating a series expansion of the mean reflection coefficient using the r.m.s. electron density fluctuation as the expansion parameter. The mean reflection coefficient obtained by one method, based on directly expanding the wave equation and boundary conditions, is evaluated for an electron density fluctuation having the form of a random telegraph signal. The result of the other method, based on the distorted wave Born approximation, is evaluated for a random amplitude fluctuation. Author (TAB)

N69-30936# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Physics.

DEPARTMENT OF PHYSICS Annual Progress Report

Kenneth C. Rogers and Robin O. Motz Feb. 1969 25 p refs

(Contract AT(30-1)-2813)

(SIT-2813-47) Avail: CFSTI

This work is a continuation of the studies initiated in 1964 of a low-beta, magnetically confined, quiescent plasma column (Q plasma). The work consisted of four phases: (a) completion of a study of cross-field plasma loss in a single-ended potassium Q plasma; (b) completion of construction of a new Q machine, designed specifically for the generation of and optical studies of a barium Q plasma; (c) experimental optical studies of a barium Q plasma; and (d) theoretical studies of the atomic and optical properties of the Be $^+$ion. Author (NSA)

N69-31005# Harvard Univ., Cambridge, Mass. Engineering Sciences Lab

SPECTROSCOPIC INTENSITY MEASUREMENT OF ATMOSPHERIC PRESSURE HELIUM ARCS

C. C. Huang Jan. 1969 45 p refs

(Grant NSF GK-1827)

(TR-33) Avail: Issuing Activity

A spectroscopic study of wall-stabilized, atmospheric pressure helium arcs is presented. More specifically, distribution measurements are made across the arc of some HeI line emission coefficients, which are proportional to the number densities of the upper states of the lines. Previous work on arc plasmas rely strongly upon the assumption of local thermodynamic equilibrium (LTE), because the plasma properties are then functions of temperature and pressure only. Treatment and interpretation of the experimental results are thus greatly simplified. Emmons cautions, however, that the validity of the equilibrium assumption has to be checked for each gas in a confined-arc experiment. All the experimental evidences have indicated that the LTE assumption does not hold for an atmospheric-pressure helium arc below 400 A in a tube of the order of 1-cm diameter. An approach toward LTE is indicated when the helium arc pressure is raised to 10-atm, and an attempt was made to deduce the transport properties from the experimental data. Author

N69-31012# New York Univ., N.Y. Dept. of Aeronautics and Astronautics.
AN APPLICATION OF THE EXTENDED KANTOROVICH METHOD TO MHD DUCT FLOW
Harold Alexander May 1968 15 p refs
(Grant AF-AFOSR-67-0813)
(AD-675646; NYU-AA-68-4; AFOSR-68-0958) Avail: CFSTI CSCL 20/9

The extended Kantorovich method developed by A. D. Kerr and recently applied to the solution of a clamped plate by A. D. Kerr and H. Alexander, is used in the present paper to analyze the steady flow of a viscous, electrically conducting fluid through a perfectly insulated rectangular duct under a uniform, arbitrarily oriented, externally applied magnetic field. It is shown that the generated solution is independent of the choice of initial function, and that the convergence of the iterative procedure is very rapid. The obtained solution exhibits good correlation with the exact solution for small values of the Hartmann number. The inaccuracy at high Hartmann numbers is shown to be a result of a shortcoming in the method as it is presently applied. Author (TAB)

N69-31017# Sperry Rand Research Center, Sudbury, Mass.
PROPOSED METHOD OF MEASUREMENT OF ELECTRON DENSITY IN REENTRY SHEATHS BY OBSERVATION OF ELECTROACOUSTIC RESONANCES Interim Scientific Report
Claude D. Lustig and Warren D. McBee Feb. 1969 27 p refs
(Contract F19628-67-C-0096)
(AD-686458; SRRC-CR-68-50; SRRC-RR-66-32; AFCRL-69-0039; SR-2) Avail: CFSTI CSCL 20/9

A method is proposed for measuring the electron density in a re-entry sheath plasma by exciting electroacoustic waves. The waves are launched from an antenna mounted flush with the vehicle skin, and are reflected at a surface in the plasma where the local plasma frequency equals the wave frequency. By analogy with laboratory experiments, standing waves can be set up between this surface and the vehicle skin, causing a resonant decrease in the power reflected at the antenna. For this condition, the electron density gradient close to the vehicle skin can be calculated. The re-entry sheath parameters for blunted cone and slender cone vehicles are examined to determine the applicability of the method. The blunted cone re-entry sheath appears to be ideal for the observation of the resonances. For a slender-cone, the method is less appropriate because the electron density does not, in general, reach a suitable value until relatively low altitudes, where the electron collision frequency has become prohibitively high. Author (TAB)

N69-31087# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TURBULENT HEATING OF PLASMA BY A CURRENT
E. K. Zavoiskii et al 24 Jan. 1969 20 p refs Transl. into ENGLISH from Konf. Po Issled. v Obl. Fiz. Plazmy i UPR. Termoyadernykh Reaktsiy, 3d (Novosibirsk), 1968 p 1/24
(AD-686308; FTD-HT-23-1159-68) Avail: CFSTI CSCL 20/9

This report contains the results of a further study of the mechanism of the turbulent heating of plasma by a current in open and closed traps. Turbulent heating in open traps was studied using the NPR-2 and TN-5 equipment. Both devices are magnetic mirror-type systems. Author (TAB)

N69-31097# Electricity Council Research Centre, Capenhurst (England).
ARC PLASMA GENERATORS: A REVIEW OF PROPERTIES AND APPLICATIONS
P. G. Dunham Aug. 1968 49 p refs
(ECRC/R100) Avail: CFSTI

The instability of electric arcs and their lack of directional control led to the development of constricted arc plasma jets. In the open arc the arc is struck between the cathode and a workpiece. The shield gas surrounds the arc and is not appreciably heated by it. In the transferred arc torch the arc is constricted by a water-cooled nozzle and the gas passes through the arc, ionizes and attains a high temperature and velocity. This results in a narrow well-directed arc together with a high velocity jet of plasma. If the nozzle is made the anode, the torch is a non-transferred torch, the arc passes from the cathode to the nozzle and only the jet of plasma is emitted. Author

N69-31107# Lockheed Missiles and Space Co., Sunnyvale, Calif.
ON THE THEORY OF NONEQUILIBRIUM LOW-TEMPERATURE PLASMA
L. M. Biberman et al [1968] 43 p refs Transl. into ENGLISH of the book "Magnitogidrodinamicheskii Metod Poluchenia Elektroenergii" Moscow, Energiia Press, 1968 p 209–263
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

A theory is proposed which permits the determination of the degree of ionization, and the distribution of plasma particles according to states of the discrete and continuous spectra in the absence of equilibrium. Nonequilibrium is caused by relaxation processes, escape of radiation, drift of charged particles, and nonisothermy of the plasma components. The theory is based on a successive application of the diffusion approximation to particle motion in energy space. Correct accounting of the discreteness of the levels demanded utilization of finite difference apparatus. Analytic expressions have been found for the level populations, the ionization rates, and the velocity distribution functions for the electrons. A comparison is made with experimental research. Author

N69-31128# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
INVESTIGATION OF UNIVERSAL PLASMA INSTABILITIES Quarterly Report, 1 Jun.–31 Aug. 1968
Aug. 1968 9 p refs
(Contract AT(40-1)-3405)
(ORO-3405-25) Avail: CFSTI

A brief review of research carried out during this period is given on ion acoustic waves and periodic pulling and turbulence in Q devices. NSA

N69-31151# California Univ., Berkeley. Lawrence Radiation Lab.
TRANSPORT OF A PARTIALLY IONIZED PLASMA ACROSS A MAGNETIC FIELD
Laird Warren (Ph.D. Thesis) 30 Sep. 1968 251 p refs
(Contract W-7405-ENG-48)
(UCRL-17601) Avail: CFSTI

Experiments were made on the partially ionized secondary plasma of a magnetically collimated hollow-cathode arc discharge. Experiments were done in He, H_2, Ar, and N_2 for neutral pressures of 1.5 to 7 m torr with a magnetic field of 300 to 1680 G in a diffusion chamber 58.2 cm long and 20 cm in diameter. The plasma produced falls off radially from a density of 10^{13} to 10^{14} cm^{-3} with $kT_e \approx 8$ eV in the center of the discharge to 10^{10} to 10^{11} cm^{-3} with $kT_e < 0.5$ eV near the wall. Detailed measurements on the plasma density, potential, and electron temperature as a function of spatial position have been made with Langmuir probes for a variety of experimental conditions. From these measurements the values of the diffusion coefficients and electric fields are estimated, and the particle transport rates and particle accumulation rates due to various processes are deduced and compared. The transport of this partially ionized plasma across a magnetic field is determined by diffusion, mobility, and convection. Author (NSA)

N69-31157# British Petroleum Co., London (England). Research Centre.

THE PLASMA ARC AS AN EXCITATION SOURCE FOR THE EMISSION ANALYSIS OF SOLUTIONS

P. R. Mason 10 Feb. 1968 13 p refs

(TM-110-182) Avail: CFSTI

The plasma arc is introduced as a new approach to the problem of solution analysis employing emission spectroscopic techniques. The plasma arc can be used as an excitation source for the analysis of aqueous solutions, gasolines, and lubricating oils. Spectral interference can arise from CN, OH, and CH bands according to the solution type under analysis and also from argon lines due to the carrier gas. Author

N69-31241# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

ULTRAFAST DIAGNOSTIC SPECTROSCOPY OF A PLASMA CREATED BY FOCUSING A LASER BEAM ON A GAS [DIAGNOSTIC SPECTROSCOPIQUE ULTRA-RAPIDE D'UN PLASMA CREE PAR FOCALISATION D'UN FAISCEAU LASER SUR UN GAZ]

C. Cesari, T. Consoli, C. Jacquot, L. Slama, and P. Stevenin 20 Jun. 1968 38 p refs In FRENCH Presented at the Conf. on Plasma Diagn., Culham (Engl.), 19 Aug. 1968

(CEA-CONF-1060; IGn/RT-604; CONF-680831-2) Avail: AEC Depository Libraries

The time evolution of the density and temperature of a plasma created by focusing a ruby laser beam on a vessel containing argon at a pressure between 300 and 760 torr was studied. The temperature was evaluated by comparison of the intensities of two emission lines of the plasma, and the density was measured from the Stark effect. A spectroscopic ensemble was used, composed of two light amplifiers operating in streak sweep and associated with a spectrograph that makes it possible to obtain the evolution of the profile of the emission lines directly on a photographic plate. The evaluation of the density relied on the numerical results of the Griem quantum theory, in which the validity limit is placed toward high electron density. The validity of the temperature measurement is discussed, analyzing the hypothesis of local thermodynamic equilibrium in which the limits appear toward the low densities. NSA

N69-31262# Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Instituut voor Plasma-Fysica.

STEPWISE IONIZATION AND ATOMIC LEVEL POPULATIONS IN A HELIUM DISCHARGE

R. Mewe Feb. 1969 91 p refs

(NP-17810; REPT-69-50) Avail: AEC Depository Libraries

A study was made of the ionization of excited atoms in a gas discharge in helium. On the basis of a simplified helium level diagram the density of the atoms in the excited states $2\,^1S$, $2\,^1P$, $2\,^3S$, and $2\,^3P$ and the rate of ionization have been computed for a stationary homogeneous plasma cylinder. The calculations have been done on a computer in the following range of parameters: filling gas pressure p = 0.1–10 Torr, electron density n_e = 10^{14}–10^{18} m^{-3}, reduced axial electric field E/p = 100 to 6000 V m^{-1} $torr^{-1}$, and plasma radius R = 0.005 to 0.02 m. A dual-beam absorption experiment has been carried out on the same discharge to check the calculated level populations. The radiation from an electrodeless rf helium source is passed across the positive column. The measured attenuation at the wavelength of a particular spectral line yields the population density of the lower level of this line. In the case of the triplet lines the influence of the fine structure on the absorption has been calculated. Author (NSA)

N69-31308# Illinois Univ., Urbana. Coordinated Science Lab.

OBSERVATION OF SURFACE MODES EXCITED BY AN ELECTRON BEAM IN A PLASMA

H. Boehmer and M. Raether Apr. 1969 15 p refs

(Contract DAAB07-67-C-0199)

(AD-686374; R-411) Avail: CFSTI CSCL 20/9

Unstable oscillations at frequencies below the plasma frequency are observed at the plasma boundary during the interaction of an electron beam with a plasma. These oscillations are interpreted as the eitenmodes of the inhomogeneous plasma boundary, driven into instability by the beam. Author (TAB)

N69-31371# Stichting Voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Instituut voor Plasma-Fysica.

MAGNETO-ACOUSTIC OSCILLATION OF A PLASMA CYLINDER: NORMAL MODE ANALYSIS UP TO SECOND ORDER

W. Schuurman Nov. 1968 18 p refs Supported in part by EURATOM

(NP-17813; Rept-68-48) Avail: AEC Depository Libraries

A theory is presented of radial magneto-acoustic oscillations of a plasma cylinder surrounded by vacuum, following a linearization procedure of MHD-equations, with second order included. Comparison with a numerical example taken from a Rijnhuizen screw pinch shows qualitative agreement. Author (NSA)

N69-31380*# Aztec School of Languages, Inc., Acton, Mass. Research Translation Div.

DETERMINATION OF PLASMA PARAMETERS ACCORDING TO THE INTENSITY OF THE CONTINUOUS SPECTRUM [OPREDELENIYE PARAMETROV PLAZMY PO INTENSIVNOSTI SPLOSHNOGO SPEKTRA]

M. B. Chelnokov Washington NASA Jul. 1969 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (Tomsk), no. 1 1969 p 12–17

(Contract NASw-1692)

(NASA-TT-F-12378) Avail: CFSTI CSCL 20I

A relationship between the spectral intensity of recombination radiation and the coefficient of recombination is obtained. It is shown that a determination of the temperature of the electrons according to the intensity of the continuous spectrum is possible even when the ratio between the intensity of recombination radiation and the bremsstrahlung is unknown. Methods are developed to determine the coefficients of recombination and the distribution functions of electrons in terms of the velocity and the intensity of the continuous spectrum. Author

N69-31386# California Univ., Berkeley. Lawrence Radiation Lab.

QUASILINEAR EVOLUTION OF THE TRANSVERSE INSTABILITY DRIVEN BY TEMPERATURE ANISOTROPY OF AN UNMAGNETIZED PLASMA

Norman Webster Albright (Ph.D. Thesis) 28 Jan. 1969 135 p refs

(Contract W-7405-ENG-48)

(UCRL-18751) Avail: CFSTI

Starting with a temperature anisotropic plasma, a spectrum of purely growing magnetic waves develops in k-space. These waves cause particle diffusion in velocity space. This leads to temperature isotropy and thus to stabilization of the plasma. After a brief period of rapid diffusion, the anisotropy decreases with time like $t^{-2/3}$. Simultaneously the wave spectrum shifts to lower and lower wave numbers, and eventually decays. Author (NSA)

N69-31454# General Electric Co., Philadelphia, Pa. Missile and Space Div.
PREIONIZATION IN NON-EQUILIBRIUM PLASMAS Annual Summary Report
Norman A. Evans Mar. 1969 32 p refs
(Contract F44620-68-C-0048)
(AD-686104; AFOSR-69-0985TR) Avail: CFSTI CSCL 20/9

An experimental study of the preionization process in non-equilibrium plasmas has been started in a cesium-seeded argon mixture. The work is being performed in a boron nitride channel containing twelve electrode pairs, each equipped with a discharge holder at a gas stagnation temperature of 1500K. Mach numbers up to M = 0.6 and transverse magnetic field strength up to B = 22,500 gauss. For discharge currents of three amps, the results showed that steady, stable behavior was obtained up to M = 0.6 for B = 0, with the discharge holders fully effective in controlling the current path. However, discontinuous increases in electrode voltage were observed with magnetic field, and on the basis of probe readings it was concluded that the first discharge had jumped to the next adjacent holder downstream. Author (TAB)

N69-31458# Stichting Voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Inst. Voor Plasma-Fysica.
TEMPERATURE DISTRIBUTION IN A HYDROGEN PLASMA COLUMN EMBEDDED IN A STRONG MAGNETIC FIELD
J. Rem, and M. P. H. Weenink Oct. 1968 22 p refs
(NP-17811; REPT-68-47) Avail: AEC Depository Libraries

The model to be investigated is a cylindrical, quasi-neutral, fully ionized plasma which is placed in a magnetic field directed along the axis of the cylinder. The plasma is in a stationary state and in local thermal equilibrium. The magnetic field is taken to be strong. The products of the cyclotron frequency and the collision time for the electrons and ions, respectively, should be large compared to unity. The current along the column is assumed to be the only energy source. The electric field which sets up this current is independent of the radius. It is shown that there exists a simple relationship between the density and the temperature combined with which the energy equation yields a nonlinear differential equation for the temperature. This equation can be transformed into an elementary linear one and solved exactly. The last section contains a discussion on the validity of the result and a comparison of it with the more complete results obtained with the help of a computer. Author (NSA)

N69-31532# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Physics.
MECHANISM AND DYNAMICS OF COAXIAL PLASMA ACCELERATION Interim Technical Report
W. H. Bostick, L. Grunberger, and W. Prior Mar. 1969 10 p refs
(Grant AF-AFOSR-465-67)
(AD-686103; SIT-P234; ITR-2; AFOSR-0984TR) Avail: CFSTI CSCL 20/9

It is shown by 5-nanosecond image converter photography and neutron scintillators that the neutrons coming from the plasma focus at the end of a plasma coaxial accelerator are produced by the mutual annihilation of ortho plasma vortices and not by the m = o, MHD instabilities or by the symmetrical compressions which were previously credited with leading roles in neutron production in all z pinches. Author (TAB)

N69-31534# Academy of Sciences (USSR), Moscow. Atomic Energy Inst.
SOME ELECTRICAL PROPERTIES OF DENSE PLASMA [NEKOTORYE ELEKTRICHESKIE SVOISTVA POLOTNOI PLASMY
V. A. Alekseev 1968 8 p refs In RUSSIAN
(IAE-1626) Avail: AEC Depository Libraries

Experimental data is given on the measurement of electrical conductivity of cesium in the supercritical region. It is shown that in a gaseous state cesium may have high conductivity approaching that of metals. A. M. Dykhne (1964) stated a hypothesis on the feasibility of creating high-density plasma with positive and negative ions, in which conductivity is determined by the tunnel jump of electron. An attempt is undertaken in the work to obtain such a plasma by making use of a jet of sodium and chlorine vapor. The considerable interest which has appeared of late in regard to dense plasma was brought about first of all by the feasibility of creating a working substance with high conductivity for MHD transformation and by an urge towards a more thorough understanding of the conductivity of a condensed state of material. A special feature of such a plasma is the existence of quantum effects brought about by the overlap of the wave functions of the electrons. N

N69-31575# Air Force Academy, Colo. Frank J. Seiler Research Lab.
ON AN ELECTRIC-CURRENT-CARRYING DISCONTINUITY DRIVEN THROUGH NON-CONDUCTING GAS BY A LORENTZ FORCE
Roger W. Gallington Dec. 1968 190 p refs
(AD-685748; SRL-68-0008) Avail: CFSTI CSCL 20/9

A physical model is presented for an electric current carrying discontinuity separating two uniform states in a flowing gas. The physical model is composed of a thin shock wave followed closely by a thicker current sheet in which the viscosity and thermal conductivity are zero. The electrons and ions move only in the plane of the current sheet (in discontinuity fixed coordinates) and have no component of velocity in the streamwise direction. The momentum and energy exchange terms occurring in the species momentum and energy equations reduce to a particularly simple form based on a slightly ionized gas and a constant collision frequency model. Coulomb attraction causes the electron charge density to equal the ion charge density. A three fluid analysis (electrons, neutrals, and singly ionized ions) of this model is made for the case where the component of the magnetic field normal to the plane of the discontinuity is zero. The analysis results in a system of equations involving two ordinary differential equations. The values of all the dependent variables in the current sheet are computed from these equations as a function of distance in the streamwise direction. It is found that this model will admit solutions finite strength current sheets. Author (TA

N69-31629*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
POPULATION OF THE EXCITED STATES OF ATOMS AND IONIZATION IN NON-EQUILIBRIUM CESIUM PLASMA OF LOW PRESSURE [ZASELENNOST VOZBUZHDENNYKH SOSTOYANIY ATOMOV I IONIZATSIYA V NERAVNOVESNOY TSEZIYEVOY PLAZME NIZKOGO DAVLENIYA]
M. B. Chelnokov Washington NASA Jul. 1969 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (Tomsk) no. 1, 1969 p 52–58
(Contract NASw-1692)
(NASA-TT-F-12379) Avail: CFSTI CSCL 20i

A system of nonlinear algebraic equations is obtained in order to determine the population of 20 lower levels of cesium in a nonequilibrium plasma of low pressure, with a consideration of a large number of elementary processes. This system of equations is solved on an electronic computer. The results are compared to the experimental data which are found in the literature. The coincidence is satisfactory. In addition to the population of the levels, the coefficient of ionization and the concentrations of molecular cesium ions are obtained from the solution. Author

N69-31701# Akademiya Nauk SSSR, Novosibirsk. Inst. Yadernoi Fiziki.
INVESTIGATION OF THE STABLE STATE OF AN EVACUATED PLASMA IN A Q-MACHINE [ISSLEDOVANIE USTOICHIVOGO SOSTOYANYAI RAZREZHENNOI PLAZMY V Q-MASHINE]
A. V. Gurevich, R. A. Salimov, and N. S. Buchel'nikova 1968 20 p refs In RUSSIAN *Its* Preprint 208
(NP-17786) Avail: AEC Depository Libraries

An investigation was made of the stable state of a thermally ionized plasma in a Q-machine. A case is examined thoretically when the plasma potential is negative. The distribution functions of electrons and ions have been found. Expressions have been obtained for the plasma potential, the floating potential of the electrode and its volt-ampere characteristic. The results of the calculation are compared with the experiment. Author (NSA)

N69-31758# Colorado Univ., Boulder.
BAROCLINIC, ALFVEN AND ROSSBY WAVES IN GEOSTROPIC FLOW
Peter A. Gilman Mar. 1969 28 p refs
(Contract F19628-67-C-0304)
(AD-685173; SR-4; AFCRL-69-0091) Avail: CFSTI CSCL 20/9

Further results are given concerning geostrophic baroclinic flow in a zonal magnetic field. In particular, the following are given: (1) a necessary condition for instability that is analogous to one for stratified shear flow found by Howard and Miles; (2) bounds on the phase velocities of all neutral oscillations; (3) explicit solutions for these neutral modes in certain cases; and (4) solution to the Eady problem (baroclinic flow with constant shear) in a zonal magnetic field without and with the beta effect. TAB

N69-31763# Los Alamos Scientific Lab., N.Mex.
STABILITY OF THE DENSE PLASMA FOCUS
Joseph W. Mather, Paul J. Bottoms, James P. Carpenter, Arthur H. Williams, and Kenneth D. Ware 15 Jan. 1969 11 p refs
(Contract W-7405-ENG-36)
(LA-4088) Avail: CFSTI

The influence of small dc "axial" magnetic fields upon the stability of a focused plasma column is shown by use of soft x rays. Material damage to the center electrode and the intense x-ray emission at the electrode face resulting from electron bombardment are considerably reduced. Although the final heating of the ions and electrons is inhibited as expected owing to a trapped magnetic field, the spatial stability of the focused column offers greater possibility for scaling to higher energies. Author (NSA)

N69-31791# Academy of Sciences (USSR), Moscow. Inst. Atomnoi Energii.
ELECTRICAL CONDUCTIVITY AND ENERGY BALANCE IN A NONEQUILIBRIUM PLASMA. 2: VAPORS OF NEON-CESIUM, KRYPTON-CESIUM, AND XENON-CESIUM MIXTURES [ELEKTROPROVODNOSTII BALANS ENERGII V NERAVNOVESNOI PLAZME. 2. SMESI NEON-TSEZII, SENON-TSEZII]
Yu. M. Voklov and D. D. Malyuta 1968 20 p refs In RUSSIAN
(IAE-1619) Avail: AEC Depository Libraries

Results are given of an experimental investigation of a nonequilibrium plasma of a pulsed discharge in the mixtures of inert gases with cesium; in particular, the electron-energy balance and electrical conductivity of such a plasma are examined and also the times for reaching ionization equilibrium in the pure inert gases and critical parameters of the current-conducting channel. A brief review is given of the existing methods of calculating the electrical conductivity of the plasma with intermediate stages of ionization. The experimental results obtained are compared with the calculations by different methods with the aim of selecting from among them one most convenient for the engineering calculations. A simple method of calculation is suggested which does not require the employment of electronic computers and which provides a sufficient accuracy in the region of the degrees of ionization being examined. NSA

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N69-30402*# Massachusetts Inst. of Tech., Cambridge.
STRUCTURE OF SURFACES AND THEIR INTERACTIONS
H. C. Gatos *In* NASA, Washington Interdisciplinary Approach to Friction and Wear 1968 p 7-84 refs (See N69-30401 17-15)
Avail: SOD $2.25; CFSTI CSCL 20L

The salient characteristics of crystalline solid surfaces are discussed with primary emphasis on their structural aspects. Direct experimental approaches to the study of the structure of surfaces and their limitations are considered together with some theoretical models. The interactions of solid surfaces with gases, liquids, and solids are outlined and assessed in terms of their fundamental and technological significance. A number of surface science areas in need of improved understanding are pointed out in the light of the ever increasing technological importance of surface phenomena. Author

N69-30403*# Burndy Corp., Norwalk, Conn.
TOPOGRAPHY OF SOLID SURFACES
J. B. P. Williamson *In* NASA, Washington Interdisciplinary Approach to Friction and Wear 1968 p 85-142 refs (See N69-30401 17-15)
Avail: SOD $2.25 CFSTI CSCL 20L

Methods of examining surfaces are reviewed and comments are made on the advantages and limitations of each. The recently developed techniques of numerical surface analysis and micromapping are described, and the new picture they give of the topography of surfaces and of the nature of static contact is discussed. The approach to contact theory suggested by this new picture emphasizes the equal importance of the shape of individual asperities and the statistics of the height distribution of the entire population of asperities on the surface. A recent instrumental development, the relocating stage, has permitted the observation of individual asperities before and after contact. Experiments are described in which the progressive crushing of asperities was measured as the load on them was increased to many times their nominal yield pressure. These have revealed some previously unobserved aspects of the behavior of surfaces under extreme loads. Finally, a possible topographic mechanism of wear is suggested, and a simple experimental investigation of the proposal is described. Author

N69-30415 Tennessee Univ., Knoxville.
OPTICAL AND PHOTOEMISSIVE PROPERTIES OF EVAPORATED FILMS OF PALLADIUM, NICKEL, AND COPPER IN THE VACUUM ULTRAVIOLET SPECTRAL REGION
Robert Chase Vehse (Ph.D. Thesis) 1968 252 p
Avail: Univ. Microfilms: HC $11.50/Microfilm $3.25 Order No. 69-1288

The optical properties of palladium were measured for the spectral region of 2 to 24.5 eV, and the optical properties of nickel

were measured for the region of 4 to 24 eV. Analyses of the data required use of the Kramers–Kronig method combined with direct solution of Fresnel equations at selected photon energies to obtain reasonably accurate values of the optical functions in the spectral region under investigation. Photoemission studies were made of palladium, nickel, and copper to determine the properties of the excited photoelectrons within the metal. Photoexcitation energies in the range of 10.2 and 22.4 eV were used, and the photoemission currents were recorded as functions of a retarding voltage. The energy distribution curves were obtained from the derivatives of the current versus voltage curves, and the results were found to be in good agreement with previously reported energy distribution curves measured for excitation energies below 11.8 eV.
Dissert. Abstr.

N69-30432 Northwestern Univ., Evanston, Ill.
TWO-BAND GALVANOMAGNETIC EFFECTS IN GRAY TIN
Charles Frederic Lavine (Ph.D. Thesis) 1968 140 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-1880

A study has been made of the temperature, magnetic field, and doping dependence of the conductivity, Hall coefficient, and magnetoresistance of gray tin. The measurements were interpreted within the framework of the Groves–Paul band structure model for gray tin and allow the determination of several of its parameters, as well as an investigation of the charge carrier scattering mechanisms. By suitable choice of temperature and doping, conduction was limited to at most two bands so that the single band characteristics could be obtained using the standard two-band theory.
Dissert. Abstr.

N69-30451 Illinois Univ., Urbana.
THERMODYNAMIC PROPERTIES OF CRYSTALS CONTAINING IMPERFECTIONS
Jon Thomas Holder (Ph.D. Thesis) 1968 110 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-1360

Using thermodynamics and elasticity theory, a unified treatment of changes in the properties of crystals containing the major types of defects is given. Some previously derived results are recovered in the present calculations, such as the formula for volume changes of self-stressed media derived by Zener. However, the present results are of a more general nature and the method is not restricted to static, isotropic, elastic systems at zero pressure. For defects described by elastic strains, it is shown that the required pressure and temperature dependence is given by using the known pressure and temperature dependent elastic constants in place of the zero pressure elastic constants in the linear elasticity results.
Dissert. Abstr.

N69-30552 Maryland Univ., College Park.
PROPAGATION OF MAGNETOSTATIC SPIN WAVES IN YTTRIUM IRON GARNET
Edward Raymond Burke (Ph.D. Thesis) 1968 102 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-712

The propagation of magnetostatic spin-waves in single-crystal cylinders of yttrium iron garnet was investigated both theoretically and experimentally with the aim of developing a sensitive new technique for measuring ferromagnetic relaxation times. The theoretical study showed that if the dimensions of the sample are properly chosen there will exist a range of applied magnetic field over which the attenuation will increase linearly with time delay; the relaxation times can then be obtained from the slope of the attenuation versus time delay curve. It is also shown that there are important corrections to the time delay expressions found in the literature since the spin-waves do not travel at the group velocity in the extreme dispersive limit and the excited mode is not the one which was always assumed. The experimental measurements were performed at room temperature for frequencies between 2 and 4 GHz.
Dissert. Abstr.

N69-30556 North Carolina Univ., Chapel Hill.
MICROWAVE TRANSMISSION AND REFLECTION COEFFICIENTS OF THIN SUPERCONDUCTING LEAD FILMS
Sandor Lajos Lehoczky (Ph.D. Thesis) 1968 95 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-1637

The microwave transmission- and reflection-coefficient ratios were measured for pure lead films and lead films plus thin manganese and bismuth overlays at frequencies of 23.89, 37.2, and 69.5 GHz. The results for pure lead films agree well with theoretical transmission- and reflection-coefficient ratios calculated using complex conductivities. A comparison of this result with the results of a number of other measurements suggested that the value of the gap indicated by the present measurements probably corresponds to an averaged value of the gap over the Fermi surface in lead. Anomalous changes in the microwave electromagnetic response were in the dc resistance above the critical temperature were observed for each film. These changes were attributed to phase fluctuations near the phase transition. The absence of any structure in the microwave response indicated no precursor absorption as reported by several authors.
Dissert. Abstr.

N69-30583# Norwegian Inst. of Tech., Trondheim. Electronics Research Lab.
ELASTIC SURFACE WAVES IN PIEZOELECTRICS AND THEIR COUPLING TO CARRIERS IN AN ADJOINING SEMICONDUCTOR
K. A. Ingebrigtsen Nov. 1967 137 p refs
(Elab-TE-94) Avail: CFSTI

The effect of various electromagnetic boundary conditions on the propagation of elastic surface waves in piezoelectrics is treated in terms of a perturbation analysis assuming the piezoelectric coupling to be small. Slow wave electromagnetic and elastic solutions valid for general anisotropic piezoelectrics are developed. An effective electromechanical coupling coefficient is found which governs the coupling to the adjoining medium. This coupling coefficient is given an easy physical interpretation. The adjoining medium is described in terms of an electric impedance relating tangential electric field to normal electric displacement at the surface. Particular attention is paid to the case of an adjoining semiconductor with drifting carriers.
Auth.

N69-30612 Illinois Univ., Urbana.
CALCULATIONS OF EQUILIBRIUM ANHARMONIC PROPERTIES IN BRAVAIS LATTICES WITH APPLICATION TO THE WIGNER ELECTRON SOLID
Alfred Adam Kugler (Ph.D. Thesis) 1968 187 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 69-1376

A self-consistent method for determining equilibrium properties of Bravais crystals is derived from a variational principle for the free energy, first for the independent oscillator model of a solid, then for the general case of dispersion. The method leads to a set of self-consistent equations which are identical with those derived by Choquard in the RHA, (renormalized harmonic approximation) using ring diagram summation of the cumulant expansion for the free energy. A particular approximation is shown to lead to a simpler set of equations which can properly be termed Hartree approximation with dispersion, and which in some cases offers a suitable alternative to the harmonic approximation as a starting point in carrying out calculations.
Dissert. Abstr.

N69-30624# Kernforschungsanlage, Juelich (West Germany). Institut fuer Festkoerper- und Neutronphysik.
THE EFFECT OF THE LATTICE ON SHORT-RANGE DISLOCATION MOVEMENTS [DER EINFLUSS DES GITTERS AUF KURZREICHWEITIGE VERSETZUNGSBEWEGUNGEN]
G. Alefeld Nov. 1968 120 p refs In GERMAN
(Jul-558-FN) Avail: CFSTI

Linear damping and modulation measurements on tungsten and aluminum crystal lattices were performed in order to obtain the dislocation movement potentials of the different structures. It was found that differentiation between a lattice dislocation vibration model and a dislocation model with kinks was almost impossible. However, nonlinear damping and modulation measurements established the various lattice behavior effects in crystals through the energy and propagation behavior of their dislocation motion. Transl. by G.G.

N69-30627# Kernforschungsanlage Juelich (West Germany). Institut fuer Festkoerper- und Neutronenphysik.
DEFECT PRODUCTION AN RECOVERY DURING LOW-TEMPERATURE ELECTRON IRRADIATION OF PLATINUM [DEFEKTPRODUKTION UND ERHOLUNG BEI TIEFTEMPERATUR-ELKTRONENBESTRAHLUNG VON PLATIN]
G. Duesing Feb. 1969 60 p refs In GERMAN
(Jul-577-FN) Avail: CFSTI

Low temperature electron irradiation induced lattice defects and thermal recovery processes were studied through thermal resistance measurements on platinum crystals. Observed defect production rates decreased as irradiation dosages went up to 3×10^{19}. Spontaneous recombinations and recombinations induced by sublevel shock together determined defect formation rates; sublevel recombination shocks resulted mostly in closely located Frenkel pairs. Quenching induced lattice vacancies also increased the number of spontaneous recombinations and the damage rates for low defect concentrations. Isochronous annealing processes lowered the substructure I_D–I_E of the first level and increased the second level until an optimal high temperature regime was reached between 500° and 700°K. Transl. by G.G.

N69-30640 Pennsylvania Univ., Philadelphia.
THE INFLUENCE OF THE SHAPE OF THE FERMI SURFACE ON HIGH FIELD TUNNELING AT EXTREMELY LOW TEMPERATURES
Stephen Joseph Fonash (Ph.D. Thesis) 1968 190 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 69-97

The purpose is to determine if tunneling probability patterns may be related to the energy band structure of a metal specimen. In particular, the influence of the shape of the Fermi surface on the tunneling process is studied since the most probable final states have the Fermi energy. In the analysis, the process of field ionization is treated as a rearrangement collision and the effect of the shape of the Fermi surface is included. The resulting general expressions are applied to the specific case of free helium atoms and a metal specimen of platinum. This system is chosen because the image produced displays a tunneling probability pattern and because the Fermi surface of platinum is composed of three distinct shapes which allow the importance of the geometrical form of the Fermi surface to be studied. Dissert. Abstr.

N69-30642 Pennsylvania Univ., Philadelphia.
A FIRST PRINCIPLES CALCULATION OF THE BULK MODULUS OF DIAMOND
Iza Raphael Goroff (Ph.D. Thesis) 1968 86 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-111

The bulk modulus, lattice constant, and total crystal energy of diamond were calculated. The OPW method of Herring was used to calculate the valence electron spectrum. Half of each of the doubly counted valence–valence terms was subtracted from the one-electron valence energies. The exchange potential was calculated from the Slater model. The correlation energy was calculated, alternately, from the Gell–Mann–Brueckner or from the Nozières–Bohm–Pines expressions. The exchange and correlation mark the only deviations from a strictly first principles approach. The calculated lattice constant and total crystal energy are in excellent agreement with experiment. The bulk modulus is in good agreement with experiment. The Fourier coefficients of the valence charge density of diamond were calculated and found to be in excellent agreement with experiment. Dissert. Abstr.

N69-30690 Northwestern Univ., Evanston, Ill.
HIGH-FIELD GALVONOMAGNETIC EFFECTS IN ANTIFERROMAGNETIC CHROMIUM
Aloysius John Arko (Ph.D. Thesis) 1968 157 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-1789

The effects of the antiferromagnetic superlattice on the Fermi surface of Cr were investigated by means of high-field galvanomagnetic properties of pure single crystals of Cr (resistance ratios ranging from 750 to 1760). Prior to making measurements the samples were cooled through the Neel temperature, T_N = 312°K, in a large magnetic field, H_c, applied along <100> to produce a single domain. The results are interpreted on the basis of the Lifshitz, Azbel, and Kaganov theory of high-field galvanomagnetic effects. The topological features of the Fermi surface are shown to be consistent with a single direction of open orbits parallel to H_c. On the basis of this model, open orbits are a direct result of the superlattice energy gaps which form magnetic Bragg reflection surfaces. Dissert. Abstr.

N69-30725# Norges Tekniske Hoegskole, Trondheim. Elektronikklaboratoriet.
ANOMALOUS CURRENT FLOW AND INSTABILITY IN NONUNIFORM GERMANIUM CRYSTALS [ANOMAL STROMLEDNING OG USTABILITETER I IKKE-UNIFORME GERMANIUMKRYSTALLER]
Rolf H. Haugen, Arne Nesheim, and Tore Wessel-Berg Jun. 1967 35 p refs In NORWEGIAN; ENGLISH summary
(Elab-AE-82) Avail: CFSTI

Experimental results are presented on oscillations in the megacycle range in germanium at room temperature. Prismatic crystals with ohmic tin contacts and a constriction in the center exhibited current oscillations over a range of fairly large resistivities for n- as well as p-type material. The potential distribution was explored by means of diagnostic methods involving fine tungsten probes that could be moved along the crystal surface. The oscillations were always accompanied by a region of strong field enhancement caused by formation of a dipole layer of charge displaced towards the positive contact, for n- as well as p-type material. A theory is proposed that explains the major experimental findings as due to a combination of nonisotropic mobility caused by velocity saturation and nonuniform electric fields. It is shown that this gives rise to nucleation of dipole layers of charge which are nonstationary in the saturated domain, thus causing periodic fluctuations in the current. Author

N69-30743 Boston Univ., Mass. Graduate School.
AN INVESTIGATION OF SPIN-LATTICE RELAXATION TIME OF bcc SOLID HELIUM-3
Wijit Senghaphan (Ph.D. Thesis) 1968 144 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 68-18152

The spin-lattice relaxation time of solid He^3 in bcc phase in the temperature range of .06°-1.2°K is investigated. The study includes effects of ultrasonic pulse generated in the solid. Both CW and pulse NMR techniques in the frequency range of 6.4 to 10.8 Mc/sec were used in the measurement of relaxation times. At temperatures below 0.25°K, two exponential recovery time constants are observed by means of the CW method. For a molar volume of 22.1 cm^3, the two time constants are about 9 and 180 seconds, and are identified as the observed exchange-lattice and the lattice-external bath relaxation times, respectively. The lattice-external bath time depends on the Kapitza resistance at the interface between the solid He^3 sample and the copper cavity wall. The Kapitza resistance determined from the observed T_1 is found to be $\times 10^4$ T^{-3} deg cm^2/watt. Dissert. Abstr.

N69-30772# Norges Tekniske Hoegskole, Trondheim. Elektronikklaboratoriet.
ELECTRICAL PROPERTIES OF VACUUM-DEPOSITED SILICON OXIDE FILMS [ELEKTRISKE EGENSKAPER TIL PADAMPEDE SILISIUMOKSYDFILMER]
Sverre Bergmann Jun. 1966 82 p refs In NORWEGIAN; ENGLISH summary
(Elab-VT-86) Avail: CFSTI

The influence of some of the deposition parameters on the electrical properties of vacuum-deposited SiO-films has been investigated. It is found that conductivity, permittivity, and dielectric losses are strictly related to the degree of oxidation of the film which is in turn determined by the ratio p/v (p = pressure of oxidizing atmosphere during deposition, v = deposition rate.) Further, the investigations show that water vapor is more effective than oxygen as an oxidizing agent, and consequently gives films with better electrical properties. When a film is subjected to a dc voltage for the first time, certain anomalies in the current/voltage curves are observed. A hypothesis for the conducting mechanism in this case is proposed. According to this hypothesis, the electrical field leads to dissociation of absorbed water and thereby to oxidation of the film. Possibly a rearrangement of the structure takes place as well. The same mechanism probably occurs during heat-treatment of SiO-films. Author

N69-30863# Stanford Research Inst., Menlo Park, Calif.
GROWTH, PROCESSING AND CHARACTERIZATION OF β-SILICON CARBIDE SINGLE CRYSTALS Interim Scientific Report
Robert W. Bartlett and Robert A. Mueller Feb. 1969 26 p refs
(Contract F19628-67-C-0243)
(AD-685172; AFCRL-69-0114) Avail: CFSTI CSCL 20/2

Epitaxial vapor deposition of beta-silicon carbide was continued with diborane, aluminum trichloride, and nitrogen doping. Methods for selectively removing unwanted silicon carbide from the deposited crystals are still being sought, and work is continuing to improve thin film electrocal contects. Grinding or lapping across junctions causes poor diode performance because of surface damage and current leakage. Results on limited vapor-liquid-solid crystal growth experiments are reported. Superior electroluminescent behavior of diodes does not correlate directly with superior photoluminescent behavior. Author (TAB)

N69-30882*# McDonnell-Douglas Astronautics Co., Santa Monica, Calif.
EXPERIMENTAL INVESTIGATION OF ULTRAHIGH VACUUM ADHESION AS RELATED TO THE LUNAR SURFACE Quarterly Progress Report, 1 Apr.–31 Jun. 1969
J. J. Grossman, J. A. Ryan, and M. W. Wegner 26 Jun. 1964 12 p refs
(Contract NAS7-307)
(NASA-CR-103228; QPR-1B) Avail: CFSTI CSCL 20B

Non-polygonized dislocation arrays in naturally deformed olivine were observed for the first time on each of the principal crystallographic planes. Improved replication and etching techniques have provided sharp etch figures which will be important for studying the Apollo lunar samples. A synthetic CaF_2 crystal was cleaved on its close packed (111) plane in UHV and a charge distribution observed. Since the crystal is relatively pure and uniform (optical grade), the electrostatic charging is most probably strain induced. Author

N69-30896 Northwestern Univ., Evanston, Ill.
INVESTIGATION OF THE De HAAS-VAN ALPHEN EFFECT IN ANTIFERROMAGNETIC CHROMIUM
John Edwin Graebner (Ph.D. Thesis) 1968 134 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 69-1837

The dHvA torque oscillations were measured in magnetic fields to 33 kG and the complicated data were analyzed by computer. Most of the data were taken with crystals which were cooled through the Néel temperature T_N in the presence of a large magnetic field H_c aligned parallel to a <100> direction. From neutron diffraction, this was known to produce a single-Q crystal interpreted as containing only a single spin-density-wave (SDW). Our initial measurements were carried out after annealing with H_c = 0. For H_c = 0, three mutually perpendicular Q's are present, but neutron diffraction experiments are unable to determine whether each SDW exists in its own domain or the three SDW's coexist throughout the crystal. Detailed investigation in high symmetry planes of a single-Q crystal revealed no dHvA data with higher than tetragonal symmetry, indicating that all the Fermi surface pieces were affected by magnetic ordering. A search was made for magnetic breakdown but with no positive results. Dissert. Abstr.

N69-30903 Illinois Univ., Urbana.
SPIN LATTICE RELAXATION OF TRIVALENT PRASEODYMIUM, TERBIUM, AND ERBIUM IN ANHYDROUS LANTHANUM TRICHLORIDE: TEMPERATURE AND MAGNETIC FIELD DEPENDENCE
Thomas Lynch Bohan (Ph.D. Thesis) 1968 180 p
Avail: Univ. Microfilms HC $8.20/Microfilm $3.00 Order No. 69-1301

The results of our measurements of the spin-lattice relaxation rates of several trivalent rare earth ions, in the temperature range 0.25–4.2°K are presented. These results were analysed within the framework of the Kronig-Van Vleck-Orbach theory, the main features of which were derived in a semi-rigorous manner. The pulse saturation method, operating at a microwave frequency of 15.5 GHz was used and through additional measurements on the same samples at 9 GHz, the frequency (or field) dependence of the relaxation rates was checked. The non-Kramers Pr:$LaCl_3$ system was bottlenecked in the direct region and hence its relaxation rate was essentially frequency independent. The Kramers system Er:$LaCl_3$ showed a direct process frequency dependence which was very close to the fourth power law of Van Vleck; the non-Kramers system Tb:$LaCl_3$ had a direct relaxation process which varied with the square of the frequency, a variation close to that predicted. Dissert. Abstr.

N69-30906 Nebraska Univ., Lincoln.
MODULATED ELLIPSOMETRY FOR ENERGY BAND STUDIES OF SOLIDS
Alvin Bruce Buckman (Ph.D. Thesis) 1968 70 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 68-18008

A new experimental method is developed for measuring the small changes due to external modulation observed in the real and imaginary parts of the optical frequency dielectric constant of solids, as functions of photon energy. The method utilizes

ellipsometer readings and phase-sensitive detection of the photomultiplier output signal. It is shown that the method allows straightforward calculations of the dielectric constants and the modulation-induced changes therein, without the use of the Kramers-Kronig analysis, which is required in standard electromagneto, and piezoreflectance experiments. Conditions where the use of a Kramers-Kronig analysis can lead to difficulty are discussed. The experiment is independent of the type of modulation employed. Spectra of the modulated dielectric constants were obtained for gold and silver. Dissert. Abstr.

N69-30981# Lehigh Univ., Bethlehem, Pa.
PRELIMINARY INVESTIGATIONS OF PURE AND ACTIVATED LEAD FLUORIDE
R. Blume and Wesley J. Van Sciver 10 Oct. 1968 7 p
(NYO-3409-30) Avail: CFSTI

Equipment for studying the photoluminescence and gamma-irradiated scintillation properties of pure and activated crystals of lead fluoride at low temperatures is described. Results are given. NSA

N69-30969# Norges Tekniske Hoegskole., Trondheim. Elektronikklaboratoriet.
NONLINEAR ANALYSIS OF BULK EFFECTS IN SEMICONDUCTORS [IKKJE-LINEAR ANALYSE AV BULK-EFFEKTAR I HALVLEIARAR]
Johannes Falnes Feb. 1967 248 p refs In NORWEGIAN
(Elab-AE-77) Avail: CFSTI

The benefits of the bulk effect in microinstrumentation devices and in other electronic applications are briefly discussed. This is followed by a theoretical analysis of nonstationary and stationary phenomena in an extrinsic semiconductor placed in a strong electric field. The distribution of the electric field and the space charge in the semiconductor is studied. A mathematical model is established which shows the functional relationship $v = v(E)$ between the electric field E and the drift velocity v in regard to the charge carriers. A resulting nonlinear first order partial differential equation is discussed and solved for an infinite medium. The general case of a finite, thick semiconductor disk is analyzed. A more detailed analysis is presented for the stationary condition near v(E). The generation of a nonstationary voltage in the semiconductor by a direct current is demonstrated under the assumption that certain conditions are fulfilled. Transl. by K.W

N69-30982 Illinois Univ., Urbana.
THERMAL CONDUCTIVITY OF SUPERCONDUCTING NIOBIUM
Jon Ross Carlson (Ph.D. Thesis) 1968 84 p
Avail: Univ. Microfilm: HC $4.40/Microfilm $3.00 Order No. 69-1311

The magnetic field and temperature dependence of the thermal conductivity of superconducting niobium have been measured in magnetic fields which ranged from zero to above the critical fields, and for temperatures which ranged from 0.31°K to above the transition temperature. Measurements were made on a single crystal cylindrical specimen for which $R_{300}/R_{4.2N} \approx 200$. The thermal conductivity in the superconducting state exhibited a maximum near 1.80°K. This maximum has been attributed to enchanced lattice conductivity as the electrons condense into the ground state. Below 0.6°K the superconducting state thermal conductivity showed an anomalous departure from the expected T^3 dependence for phonons. The departure has been interpreted in terms of a two energy gap model. Dissert. Abstr.

N69-31018# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THE RANDOM FIELD PROBLEM: PERTURBATIONS AT A LATTICE SITE DUE TO RANDOMLY DISTRIBUTED IMPURITIES Technical Report, Nov. 1968-Jan. 1969
Steven W. Duckett 17 Jan. 1969 40 p refs
(Contract F04701-68-C-0200)
(AD-686467; TR-0200(4230-13)-2; SAMSO-TR-69-92) Avail: CFSTI CSCL 20/2

The problem of computing the field or other perturbation at a lattice site due to a random collection of impurity centers is considered. The Fourier transform of the field probability density is shown to be of the form exp(-n bar psi(t)), where n bar is the average concentration of impurities and psi(t) is an integral that is a function of the individual center-impurity interactions. The Fourier transform is used to calculate numerous quantities that are functions of the random field. Emphasis is placed on computing luminescent decay forms and the energy transfer probability from one center to surrounding acceptors, but the application of these calculations to the evaluation of other quantities (e.g., partition functions) is also considered. Graphs of some of the computed functions are presented. Author (TAB)

N69-31033# European Atomic Energy Community, Ispra (Italy).
INFLUENCE OF OXYGEN ON THE THERMIONIC EMISSION OF A (110) ORIENTATED TUNGSTEN SURFACE
H. E. J. Schins and E. van Andel Brussels Apr. 1969 7 p refs
(EUR-4224.e) Avail: CFSTI

The thermionic emission of a tungsten single crystal emitter (110) was measured in an oxygen atmosphere. The saturation current was determined in the temperature range from 1600° to 2200°K in dependence of the oxygen pressure. The effective workfunction was plotted as a function of the reduced emitter temperatures (emitter temperature divided by a ficticious oxygen bath temperature). The results show the same trend as found by other investigators, i.e. the increase in effective work function caused by the adsorbed oxygen can be represented either by adsorption isotherms or isobars, or as a single function of reduced temperature. Author

N69-31078*# Sperry Rand Research Corp., Sudbury, Mass.
INVESTIGATION OF SINGLE CRYSTAL MICROWAVE ACOUSTICAL DAELY LINE MATERIALS Semiannual Progress Report, 1 Jul.-31 Dec. 1967
R. W. Kedzie and M. Kestigian Dec. 1967 16 p refs
(Contract NAS12-571)
(NASA-CR-86170; SRRC-CR-68-7) Avail: CFSTI CSCL 20L

The Czochralski direct melt crystal growth technique was used to study the growth of MgO doped and undoped $LiNbO_3$ and $LiTaO_3$ single crystals. Growth procedures are discussed in addition to methods for annealing, poling, and obtaining single domain piezoelectric materials. Differences between the niobate and tantalate systems are discussed as well as control of the coloration related to oxygen deficiencies in the melt. The as-grown crystals were fabricated into rods and polished for evaluation as microwave acoustical delay line materials. Acoustic attenuation was measured on both the doped and undoped samples. It is found that the temperature independent attenuation is less in the MgO doped samples than in the undoped samples. These results are discussed in terms of the scattering of acoustic waves by crystal imperfections and of the influence MgO doping has on crystal quality. Author

N69-31105# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF SILICON DIOXIDE ON THE GROWTH OF SILICON CARBIDE ON SILICON
Ya. V. Kalnch et al 19 Dec. 1968 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk Latv. SSR, Ser. Fiz. i Tekh. Nauk (Riga), no. 6, 1966 p 99-100
(AD-686237; FTD-HT-23-726-68) Avail: CFSTI CSCL 20/2

Single crystal films of SiC were grown on Si from methyldichloro silicon in an Ar or H atm. at 1100 degrees and investigated by electron diffraction. The presence of SiO2 on the Si surface results in an amorphour film structure. The current voltage characteristic of the heterotransition Si to amorphous SiC reveals no effect of the SiO2 film. This is ascribed to easy tunneling through the SiO2 film. TAB

N69-31116# National Aeronautical Establishment, Ottawa (Ontario).
DIFFUSION OF Cr-51 INTO POLY- AND SINGLE CRYSTALS OF NIOBIUM
J. Pelleg and G. M. Lindberg Nov. 1968 52 p refs
(NRC-10636; NRC-LR-511) Avail: CFSTI

Using a microsectioning technique, the diffusion of ^{51}Cr into niobium poly- and single crystals was measured over the temperature range 947° to 1493°C. Deviations from ideal Gaussian penetration curves were observed at lower temperatures, indicating possible short-circuit diffusion paths. Observations similar to these are reported for Nb and Ta and are believed to result from structural defects in the crystal. The results are discussed in terms of current theories for impurity diffusion. Author

N69-31123 Boston Univ., Mass. Graduate School.
A STUDY OF CHALCOPYRITE AS A DERIVATIVE STRUCTURE OF SPHALERITE
Anthony Nick Mariano (Ph.D. Thesis) 1968 28 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-18123

The crystallographic polarity of chalcopyrite was established by X-ray diffraction measurements which considered the anomalous dispersion effects. Consistent with theoretical calculations, the geometric structure factor for X-ray scattering was found to be different in opposite directions along the polar axis, and this observation enabled the two types of surfaces perpendicular to the polar axis to be identified. Euhedral chalcopyrite crystals displaying the sphenoidal form, gathered from 15 geologic locations, were also analyzed as related to anion versus cation growing direction. Polarity of chalcopyrite was further related to that of sphalerite in cases where both minerals were found intergrown. Light figure reflections used in conjunction with the etching experiments were used to establish new microcleavage planes. Finally, a high pressure phase of chalcopyrite was predicted by considering pressure effects on sphalerite-type compounds. Dissert. Abstr.

N69-31148# Joint Publications Research Service, Washington, D.C.
GUNN EFFECT AND ITS APPLICATIONS
V. M. Kuznetsov et al 7 Jul. 1969 32 p refs Transl. into ENGLISH from Izv. Vyssh. Uchab. Zaved., Radioelektron. (USSR), v. 2, no. 4, 1969 p 319–341
(JPRS-48361) Avail: CFSTI

A review of the major published works devoted to the physics, manufacture and application of devices based on the Gunn effect is given. The processes of the origination and motion of the domain of a field in a semiconductor, the methods of measuring the excited oscillations, the methods of manufacturing Gunn oscillators and also their typical parameters are examined. The established utilization of the Gunn effect in super-high-frequency oscillators, and other possible applications, in the elements and subassemblies of electronic computers are also described. Author

N69-31149# Kernforschungszentrum, Karlsruhe (West Germany) Institut fuer Angewandte Kernphysik.
TABLES OF EXPERIMENTAL ABSOLUTE TOTAL ABSORPTION PROBABILITIES, INTRINSIC EFFICIENCIES AND PEAK-TO-TOTAL RATIOS FOR LITHIUM-DRIFTED GERMANIUM DIODES
W. Michaelis Oct. 1968 10 p ref
(KFK-865) Avail: AEC Depository Libraries

Experimental values for the absolute total absorption probability, absolute intrinsic efficiency and peak-to-total ratio of lithium-drifted germanium diodes for gamma rays between 0.1 and 2 MeV are presented for several detector and irradiation geometries. The sensitive volume of the crystals considered ranges from 3.8 to 28 cm^3. Increasing attention is given to the application of such devices in gamma ray spectroscopy. The results may be used as a guide in determining the optimum experimental conditions for a given gamma ray energy. Author (NSA)

N69-31175# Boeing Scientific Research Labs., Seattle, Wash.
SOLID STATE PHYSICS LABORATORY REVIEW 1968
1968 42 p refs
Avail: Issuing Activity

Summaries of research activities are presented. Some of the topics included are: stress corrosion cracking of aluminum, magnesium, and titanium alloys; lattice thermal conductivity of alloys; pitting corrosion in aluminum and magnesium; and X-ray spectroscopy, diffraction, and astronomical telescopes. A cumulative bibliography of the Solid State Physics Laboratory is presented. F.O.S.

N69-31192# Oak Ridge National Lab., Tenn.
PROGRAM STEREO: A FORTRAN LANGUAGE PROGRAM FOR PLOTTING STEREOGRAPHIC PROJECTIONS OF LATTICE PLANE NORMALS AND DIRECTIONS
H. L. Yakel Mar. 1969 46 p refs
(Contract W-7405-ENG-26)
(PB-182925; ORNL-TM-2461) Avail: CFSTI CSCL 20B

The report describes a computer program, written in FORTRAN-63 language that may be used to plot general stereographic projections of lattice plane normals and directions in any crystal system. The basic CALCOMP plotting package for the FORTRAN language is assumed. The central axis of the projection (plotter +z) may be any specified lattice direction or plane normal. A reference plane normal in the +x plotter axis may be selected by the user or by the program. Projections of plane normals whose indices lie within chosen ranges or whose interplanar spacing exceed a chosen minimum value may be plotted. The user may elect to draw projections of equatorial circles about specified lattice directions and/or projections of the directions themselves. Author (USGRDR)

N69-31205# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
DETERMINATION OF PORTIONS OF THE BISMUTH III-V AND IV-V EQUILIBRIUM BOUNDARIES IN SINGLE-STAGE PISTON-CYLINDER APPARATUS
J. C. Haygarth, H. D. Lundemann, I. C. Getting, and G. C. Kennedy Durham, N.C. AROD [1968] 21 p refs
(Contract DA-31-124-ARO(D)-390)
(AD-686325; AROD-5570-4-C) Avail: CFSTI CSCL 11/6

The Bi III-V and IV-V equilibrium boundaries were studied by monitoring electrical resistance changes. Extrapolation of the III-V data to 25C yields an equilibrium transition pressure of 77.5 kbar. The extrapolation also agrees within experimental error with the pressure of 78.2 kbar determined in a separate experiment at 22C. The use of the transition as a calibration point is discussed and a procedure for estimating the compression-stroke transition pressure from the equilibrium transition pressure is proposed. The procedure involves adding 2 kbar to the equilibrium pressure at room temperature. Author (TAB)

N69-31302*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

SOME PROBLEMS OF INCREASING THE RATE OF CATHODE SPUTTERING IN SEMICONDUCTORS [NIEKTORE PROBLEMY ZWIEKSZENIA SZYBKOSCI ROZPYLANIA KATODOWEGO POLPRZEWODNIKOW]

Zdzislaw Majewski Washington NASA Jul. 1969 7 p ref Transl. into ENGLISH from Przegl. Tech. (Warsaw), v. 9, Jul. 1968 p 320–325

(Contract NASw-1692)

(NASA-TT-F-12053) Avail: CFSTI CSCL 20L

Introduced is a modification of the cathode sputtering method, characterized by a high rate of film removal from semiconductors and semi-insulator surfaces. Accurately defined forms of ion etched areas are attained by a simple arrangement of electrodes which increase ion reaction effectiveness on the cathode surface. Conditions which must be satisfied by this arrangement are discussed, and curves for the spatial dispersal rate of ion etching are given. Author

N69-31452# National Aeronautical Establishment, Ottawa (Ontario).

AUTOMATIC SEPARATION OF STRAIN AND PARTICLE SIZE EFFECTS IN EXPERIMENTALLY OBSERVED X-RAY LINE SHAPES: AERONAUTICAL REPORT

W. Wallace Dec. 1968 17 p refs

(AD-68311; NAE-MS-120; NRC-10641) Avail: CFSTI CSCL 20/2

A computer method is described that provides a complete analysis of experimentally observed x-ray line shapes, producing estimates of lattice strain and particle size in a single operation. It is shown that the method produces results comparable with those obtained from the conventional two-stage analysis. Author (TAB)

N69-31479# National Bureau of Standards, Washington, D.C. Inst. for Applied Technology.

METHODS OF MEASUREMENT FOR SEMICONDUCTOR MATERIALS, PROCESS CONTROL, AND DEVICES Quarterly Report, 1 Oct.–31 Dec. 1968

W. Murray Bullis Feb. 1969 41 p refs

(AD-683808; NBS-TN-475) Avail: SOD $0.45; CFSTI CSCL 20/12

The report describes activities relating to measurement of resistivity, carrier lifetime, inhomogeneities, and Hall effect in semiconductor crystals study of infrared measurement methods, properties of deep-lying impurities in In Sb, and high field effects establishment of a processing facility evaluation of aluminum metallization, wire bonds, and wafer die attachment review of NASA measurement methods and measurement of second breakdown in transistors, thermal properties of devices, and noise in microwave diodes. Projects on silicon nuclear radiation detectors and specification of germanium are also described. Author (TAB)

N69-31700# California Univ., Livermore. Lawrence Radiation Lab.

FABRICATION TECHNIQUES FOR RECENT COMPLEX MAGNET SYSTEMS

A. R. Harvey 27 Mar. 1969 17 p ref Presented at Symp. on Eng. Probl. of Fusion Res., Los Alamos, N. Mex., 8-11 Apr. 1969 Submitted for publication Sponsored by AEC

(UCRL-71540; CONF-690407-9) Avail: CFSTI

Within recent years magnetic field requirements have fostered magnet systems of ever increasing complexity. Large super-conducting magnets with nonconventional geometries, lumped solenoids that produce fields of high uniformity, and solenoids requiring greater heat dissipation properties present fabrication problems not heretofore encountered. Magnets of this type or their prototypes are currently being constructed in the magnet fabrication facility at Lawrence Radiation Laboratory, Livermore. Some of the difficulties encountered and the techniques developed for the design and fabrication of a single magnet system are reported. Author (NSA)

N69-31708# Ludwig-Maximilians-Universitat, Munich (West Germany).

THE CRYSTAL STRUCTURE OF SOME LANTHANIDE OXALATES

Wolfgang Ollendorff (Ph.D. Thesis) 1968 163 p refs In GERMAN (NP-17765) Avail: AEC Depository Libraries

The crystal structure of the lanthanide(III) oxalate-10-hydrates $Ln_2(C_2O_4)_3 \cdot 10H_2O$ for Ln = La up to Nd may be considered principally solved. On the basis of the previously evaluated Guinier diagrams of the higher terms of the series, an isotope with the first representation of this compound series can clearly be postulated. The type of lanthanide(III) oxalate-10-hydrate investigated in the present study is characterized by the formation of a layer structure in the simple AB sequence; one of the two layers is composed of the Ln^{3+} cations and the $C_2O_4^{2-}$ anions (anion–cation layer), and the other consists only of water of crystallization (water double layer). The layers are neutral. Each Ln^{3+} cation is surrounded by 6 oxalate and 3 water oxygen atoms at about equal distance, i.e., there is a nine coordination in the arrangement 1:5:3 or 1:4:4. There are complex bound oxalate ions in the form $[Ln(C_2O_4)_3 \cdot 3H_2O]^{3-}$. The lanthanide contraction is shown only two-dimensionally in the plane of the anion–cation layer; the third dimension (b axis) remains constant. Author (NSA)

N69-31716# Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.

A 3,200 ANGSTROM PHOSPHOR Quarterly Report, 1 Oct.–31 Dec. 1968

Jon W. Ogland, Edward C. Malarkey, and Michael R. Natale Apr. 1969 33 p refs

(Contract DAAB07-68-C-0392)

(AD-685832; ECOM-0392-2; QR-2) Avail: CFSTI CSCL 20/6

Near optimum doping and firing procedure were determined for the lead-doped beta-CaSiO3, with the best sample showing an efficiency nearly twice that of previously prepared samples. Work on the lead-doped alpha-CaSiO3 and beta-Ca2SiO4 was discontinued, because of unsatisfactory progress, in favor of work on the more promising lead- and thallium-doped BaSi2O5. A lead-doped BaSi2O5 was synthesized which shows an efficiency approximately equal to that of the best lead- doped CaSiO3 produced. Thallium-doped BaSi2O5 synthesis was begun. Investigation of titanium dioxide-doped Zn2SiO4 was undertaken for the purpose of producing a 3800 A emitting phosphor to replace P-16. Author (TAB)

N69-31733# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

MONOCRYSTALLINE FILMS OF CADMIUM SULFIDE

E. B. Kaganovich et al Jan. 1969 5 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 13, 1968 p 1034–1037

(Rept-114-69-204-RULL) Avail: CFSTI

An investigation of the structural properties of epitaxial monocrystalline films of cadmium sulfide grown on mica is presented. Crystallization was carried out under near equilibrium conditions, and deposition was carried out from the vapor phase on a plane of mica in an enclosed area. Results show that the electron and Laue diffraction patterns correlate and indicate that the cadimum sulfide films belong to a hexagonal modification, with the plane (0001) of the cadmium sulfide being parallel to the plane (001) of mica. Residual gas pressure was 10^{-1} torr under which chemical etching of the films occurred, and the thickness of the films produced was 10 to 100 μm. E.H.W.

N69-31793# Materials Research Corp., Orangeburg, N.Y.
THE GROWTH OF RARE EARTH OXIDE, GARNET AND ALUMINATE SINGLE CRYSTALS BY A HOLLOW CATHODE FLOAT-ZONE PROCESS Final Report, 15 Oct. 1967–14 Oct. 1968
Walter Class Wright-Patterson AFB, Ohio AFML Jan. 1969 31 p refs
(Contract F33615-68-C-1080)
(AD-686077; AFML-TR-69-4) Avail: CFSTI CSCL 20/2

The crystal growth of yttrium aluminum garnet, yttrium aluminate and yttrium oxide was carried out under this program. Large garnet crystals could be successfully grown only from feed rods where a quantity of aluminum oxide was added in excess of the $3Y_2O_3:5Al_2O_3$ stoichiometric ratio. Both doped and undoped garnets were prepared from the alumina-rich preparation. Yttrium aluminate crystals, on the other hand, were grown from stoichiometric $1Y_2O_3:1Al_2O_3$ feed rod compositions. The problems of metastability, as well as incongruence in melting, were eliminated in this compound by the addition of $1Nd_2O_3:1Al_2O_3$ which also served as the crystal dopant. Yttrium oxide crystals were also grown using differential feed rod scanning to compensate for evaporation losses from the molten zone. In the doped garnet, yttrium aluminate and yttrium oxide, crystal quality was limited by cracking.
Author (TAB)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N69-30446# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ATOMIZATION OF LIQUIDS
V. A. Borodin et al 26 Jul. 1968 181 p refs Transl. into ENGLISH of the Book "Raspylivanie Zhidkostei" Moscow, Izd. Mashinostr., 1967 p 1–262
(AD-685151; FTD-MT-24-97-68) Avail: CFSTI CSCL 21/4

The book deals with the physical bases of the atomization of liquids. The principles of action of an atomizer are examined, data about the form of streams and films created by atomizers are given. The book is designed for scientific workers and technical engineers investigating devices for atomizing liquid (for combustion chambers in engines, furnaces, equipment used in the chemical and food industry, agriculture, etc.).
Author (TAB)

N69-31348# General Dynamics/Convair, San Diego, Calif.
SUMMARY OF WORK DONE BY PROCESS DEVELOPMENT GROUP, DEPARTMENT 572-2, FOR THE PROPELLANT STORABILITY PROGRAM IN 1968
F. J. Araiza [1968] 27 p
(AD-685579; GD/C-ZZL-68-027) Avail: CFSTI CSCL 21/9.1

Test Support and Development work done in 1968 by 572-2 group for the Propellant Storability program is reported. The test support work is given as a summary of calorimeter specimens prepared. The development work includes a write-up of a method worked out for making test samples of flocked aluminized mylar, an updated version of a proposal of several insulation approaches, and work accomplished in the fabrication of a test tank which was to be used in subsequent fabrication of the selected schemes.
Author (TAB)

N69-31480# Explosives Research and Development Establishment, Waltham Abbey (England).
MEASUREMENT OF EMBRITTLEMENT TEMPERATURES (BRITTLE POINTS) OF COMPOSITE PROPELLANTS BY THE BENDING BEAM METHOD
R. W. Bryant and W. A. Dukes Oct. 1968 18 p refs
(AD-686398; ERDE-15/M/68) Avail: CFSTI CSCL 21/9.2

A bending-beam method for measuring embrittlement temperatures has been reintroduced and evaluated by comparing the results obtained with it using three different kinds of composite propellant (based on polyisobutylene, polyurethane or carboxy-terminated polybutadiene binders) with master curves of strain-at-rupture as a function of reduced strain-rate (itself a function of strain-rate and of temperature) derived independently. Three degrees of bending, imposing strains of 5, 10 and 25 per cent, were used. Good agreement between the two groups of results was found, and it is concluded that this bending-beam method is in principle suitable as a routine inspection test.
Author (TAB)

N69-31703# Harry Diamond Labs., Washington, D.C.
THIN-FILM ELECTRIC INITIATOR. PART 3: APPLICATION OF EXPLOSIVES AND PERFORMANCE TESTS
J. M. Boyd Jan. 1969 31 p refs
(AD-686281; HDL-TR-1414) Avail: CFSTI CSCL 19/1

The match-like electric initiator is a chemically deposited thin-film-bridge version of the conventional hot bridge-wire initiator and is being developed to effect a cost-saving and an increase in shock resistance. This report describes the application of the explosive to the bridge and the performance and aging tests of the completed initiator.
Author (TAB)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N69-30416# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SEMICONDUCTOR CONTROL SYSTEMS FOR MARINE ATOMIC POWER PLANTS
V. V. Pavlov 19 Nov. 1968 210 p refs Transl. into ENGLISH of the Book "Poluprovodnikovyye Upravlyayushchiye Ustroystva Dlya Sudovykh Atomnikh Ustanovok" Leningrad, Izd. Sudostroyeniya 1964 p 1–168
(AD-685054; FTD-HT-67-151) Avail: CFSTI CSCL 21/6

The book presents the principles of calculation and design of elements and components of electronic equipment of the control system and protection of marine nuclear power plants using semiconductor instruments. The features of semiconductor instruments used in the control system and protection of a nuclear reactor and the reliability of semiconductor equipment under radioactive irradiation are examined. The book is intended for engineers and technicians concerned with the development, design, and use of control systems and protection systems of marine nuclear power plants and for students of higher educational institutions.
TAB

N69-30417# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A "CONSUMPTIONLESS" TURBINE? IT IS POSSIBLE
A. Dobrotvorskiy 5 Aug. 1968 8 p Transl. into ENGLISH from Tekhn. Molodezhi (Moscow), no. 2, 1967 p 37
(AD-685060; FTD-HT-23-415-68) Avail: CFSTI CSCL 21/5

The possibility of designing a consumptionless turbine (a turbine with a contactless energy transfer from hot gases to the turbine) is discussed and illustrated. An experiment has established that a disk can be set in rotatory motion by a conventional electric hand vibrator whose vibrating element is brought into contact with the disk surface. Based on this fact, a consumptionless turbine model was developed with the flow supplied by a vacuum cleaner. Author (TAB)

N69-30560*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN OF INJECTORS AND ABLATIVE THRUST CHAMBERS FOR A FLOX-PROPANE ROCKET ENGINE WITH A 1.2-INCH THROAT DIAMETER
Jerry M. Winter, Donald A. Peterson, and Albert J. Pavli Washington Jul. 1969 38 p refs
(NASA-TN-D-5324) Avail: CFSTI CSCL 21H

An in-house study was conducted for the design and testing of liquid FLOX-propane 1.2-inch (3.05-cm-) throat-diameter rocket engines. Experimental characteristic velocity efficiency as a function of oxidant-to-fuel ratio was determined for four different injector types. An erosion-free 300-second continuous firing capability was demonstrated using a graphite cloth phenolic chamber and nozzle operating at 100-psia (689-kN/m^2) chamber pressure and at an oxidant-to-fuel ratio of 4.5 with a delivered characteristic velocity efficiency level of 96.4 percent (97.5 percent corrected). Erosion-free operation at 200-psia (1378 kN/m^2) chamber pressure required use of a graphite throat insert. Author

N69-30912# Aerospace Corp., El Segundo, Calif. Lab. Operations.
EXPERIMENTAL INVESTIGATION OF SECONDARY LIQUID INJECTION
Kenneth P. Horn and Roy E. Reichenbach Nov. 1968 41 p refs
(Contract F04701-68-C-0200)
(AD-686465; TR-0200(4220-10)-2; SAMSO-TR-69-77) Avail: CFSTI CSCL 22/4

The effects of liquid state on secondary injection in a supersonic stream were experimentally investigated. Normal penetration and lateral spreading of the liquid jets were inferred from scattered-light and schlieren photographs. A scaling law for lateral spreading of a cold-water jet, including Mach number dependence, was determined, and the data on normal penetration were used to extend existing correlations to lower injection pressure ratios. The effect of vapor pressure on breakup of liquid jets was investigated by injecting superheated water and acetone. A nondimensional penetration height was correlated with injector pressure ratio for superheated liquid injection, and the importance of thermodynamic properties on normal penetration was examined in view of these results. Author (TAB)

N69-30918# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STRENGTH OF TURBINE DISKS
V. P. Rabinovich Nov. 1968 125 p refs Transl. into ENGLISH of the publ. "Prochnost Turbinnykh Diskov" Moscow, Izd. Mashinostroyeniye, 1966 p 1–151
(AD-685055; FTD-HT-23-78-68) Avail: CFSTI CSCL 21/5

The book reviews theoretical principles of methods and experimental findings which serve for evaluating disk strength. The effect of properties of materials, systems of disks and operational conditions which affect disk strength are discussed and basic requirements which disk materials and systems have to satisfy are stressed. Special attention is paid to problems of preventing brittle and quasibrittle failures of disks and other machine parts. Author (TAB)

N69-30980*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF THE DYNAMIC RESPONSE OF LIQUID JET ATOMIZATION TO ACOUSTIC OSCILLATIONS
Marcus F. Heidmann and John F. Groeneweg Washington Jul. 1969 44 p refs
(NASA-TN-D-5339) Avail: CFSTI CSCL 21E

An atomization model prescribing jet breakup when jet distortion caused by aerodynamic forces attains a critical value is used to analytically and numerically evaluate the atomization rate perturbations caused by acoustic oscillations. The varied dynamic response within traveling, standing, and radial transverse acoustic modes is presented. An amplifying effect of a steady tangential velocity on dynamic response is also examined and compared with experimental evidence. The results generally imply that jet atomization dynamics can significantly affect the stability of a rocket engine combustor. Author

N69-31049# Giessen Univ. (West Germany). Inst. of Physics.
THE RADIO FREQUENCY ION THRUSTORS
Horst W. Loeb 1969 16 p refs Presented at 9th Intern. Aeron. Congr., Paris, 2–4 Jun. 1969 Sponsored by Ger. Min. of Sci.
Avail: CFSTI

The ion thrustors differ from contact ion engines by using mercury as propellant, and from the bombardment type ionizer by working with a self-sustaining, electrodeless, radio frequency discharge. The advantages of this ion source are the following: (1) No electrode problems and lifetime limitations occur; more than 10,000 ignitions and restart cycles of each RF-engine are proved. (2) A special extraction system, using an ion focusing effect, enables a high propellant efficiency (e.g. 90 to 95%). (3) The jet homogenity reaches about 100%, due to the discharge mechanism. Furthermore, discharge and beam diagnostics are undertaken. To study scaling laws and to develop microthrustors of 50 W and main propulsion units of 50 cm diameter, five ionizers of different size are now under optimization. Author

N69-31060# New York Univ., N.Y. Dept. of Aeronautics and Astronautics.
THEORY OF ACCELERATED ROCKET NOZZLES
H. H. Chiu Aug. 1968 34 p refs
(Contract Nonr-285(63))
(AD-686181; NYU-AA-68-30) Avail: CFSTI CSCL 21/8

The effect of the high acceleration of the rocket on the gas flow patterns in the nozzle and its performance characteristics are examined within one dimensional, quasi-steady formalism. The basic flow pattern in such a nozzle is predicted from the isentropic gas table through the use of Equivalence Principle established in the analysis. The result of the analysis indicates that for a given stagnation condition in the combustion chamber, the velocity and the pressure of the gas at the exit of the accelerated nozzle is larger than that in the non-accelerated nozzle with the same cross sectional areas at the sonic throat, and also at the exit of two nozzles. The mass flow rate, the specific impulse and the total thrust are also found to be larger for the accelerated nozzles. The effect of the acceleration is found to be important for a highly accelerated nozzle with lower stagnation temperature. Author (TAB)

N69-31101# Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Institut Fuer Chemische Raketenantriebe.

A METHOD TO MEASURE THE HUMIDITY IN SPRAY COOLERS OF HIGH-ALTITUDE PROPULSION ENGINE TEST FACILITIES [EIN VERFAHREN ZUR FEUCHTEMSSSUNG IN EINSPRITZKUEHLERN VON RAKETENHOEHENPRUEFSTAENDEN]

J. Nitsch and Kaeser Apr. 1969 43 p refs In GERMAN; ENGLISH summary

(DLR-FB-69-24; DVL-857) Avail: CFSTI

A method to measure the humidity in gases on the base of Dalton's law is selected from various possibilities of measuring the moisture content in vapor–inert gas mixtures. The special test conditions of high-altitude propulsion engine test facilities were taken into consideration. The physical principles are derived and the attainable accuracy is estimated. The measuring arrangements at the test plant and in the laboratory are described. Calibration experiments and the use at the test plant have shown the method being suitable for measuring high moisture contents, which are present in spray coolers of high altitude propulsion engine test facilities. Author

N69-31104# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TEMPERATURE STATE OF ROTOR AND HOUSING OF THE GT-750-6 GAS TURBINE

A. L. Kuznetsov et al 19 Dec. 1968 17 p refs Transl. into ENGLISH from Energomashinostr. (Moscow), v. 13, no. 12, 1967 p 15–18

(AD-686235; FTD-HT-23-117-68) Avail: CFSTI CSCL 21/5

Theoretical and experimental data are compared for the temperature field in the working section of gas turbine installation designed for driving the pump in booster stations on gas mains. The dimensionless formulas used for determining the coefficients of heat transfer from the rotor to the ambient air are given as well as expressions for the temperature of the gas on the working blades, the radial velocity of the gas, and the coefficients of heat transfer from the gas to the rotor. The theoretical computations show satisfactory agreement with measurements at various points in the disc and blade shank during operation under steady-state conditions. TAB

N69-31181# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE MEASUREMENT OF THE INITIAL GAS TEMPERATURE IN GT (GAS TURBINE) BASED ON INDIRECT PARAMETERS

S. A. Kantor et al 26 Dec. 1968 15 p Transl. into ENGLISH from Energomashinostr. (Moscow), v. 9, no. 12, 1963 p 12–15

(AD-686236; FTD-HT-23-718-68) Avail: CFSTI CSCL 21/5

The results of an investigation regarding the possible measurement of the initial gas temperature in a gas turbine through indirect parameters such as the final temperature of the gas after the turbine and the degree of expansion, are presented. The theoretical concepts supporting the application of this method and the corresponding technical approaches are included. Author (TAB)

N69-31276*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MICRO-POUND EXTENDED RANGE THRUST STAND

Kenneth W. Stark, inventor (to NASA) Filed 29 May 1969 15 p

(NASA-Case-GSFC-10710-1; US-Patent-Appl-SN-828909) Avail: CFSTI CSCL 21H

This thrust stand measures the amount of thrust generated by thrusters used on space vehicles. The range of measurement is from 1 to 50,000 micro-pounds and can be extended by modification of the structure. The thrust stand consists of a vertical tubular member that can be rotated and is held at both ends by flexible pivots. A horizontal support beam is attached to the tubular member and supports a thruster package at one end. A counter weight is mounted on the other end of the support beam to balance the weight of the thruster package. A sensor is provided for sensing the movement of the beam caused by low level thrusts. A magnetic forcer counteracts higher level thrusts so that a null balance system exists for testing higher level thrusts. The operation of the thruster and data telemetry from the sensor and other measuring devices are controlled electronically. NASA

N69-31321# Aztec School of Languages, Inc., Maynard, Mass.

CHEMICAL/ELECTROCHEMICAL PROPULSIVE SYSTEM FOR POSITION AND ADJUSTMENT CONTROL OF SYNCHRONOUS SATELLITES

Aurelio C. Robotti Mar. 1969 11 p Transl. into ENGLISH from the Proc. of the Intern. Tech. and Sci. Conf. on Space (Rome), 1–3 Apr. 1968

(Rept-68-37218) Avail: CFSTI

Described is the salient feature of a combined chemical and electrochemical propulsion system to be used for position and attitude control in synchronous satellites having a lifetime of several years. The first maneuvers are made immediately after the satellite has been placed in orbit and require a certain velocity increment to be used within a few hours after completion of the launching phase. Such an increment can be produced by a liquid H_2 + liquid O_2 propulsion system which can be stored for short times. The operations for maintaining a given altitude require a total velocity increment proportional to the life span of the satellite. A moderate increment can be produced by combustion of H_2 gas + O_2 gas produced in a continuous manner by electrolysis of water stockpile and stored under pressure in the very reservoirs that contained liquid H_2 and liquid O_2 used in gaseous phase. The resulting propulsion system has a total mass that compares well with other conventional systems of propulsion. Author

N69-31328# Giessen Univ. (West Germany).

PARAMETRIC DESIGN OF HIGH FREQUENCY PROPULSION SYSTEMS FOR TESTS IN SPACE [AUSLEGUNGSGROESSEN VON HF-TRIEBWERKEN BEI RAUMTESTS]

Josef Freisinger and Horst W. Loeb 22 May 1969 22 p refs In GERMAN

(DGLR-69-022) Avail: CFSTI

The proposed design parameters are based on a previous feasibility study of a flight test model for a solar-electric propulsion module. The design is to provide data from tests in space on the deployment and behavior of solar collector panels and on the electrical integration of fuel system and energy conversion of the ion engines. In addition, the flight is to serve as a prototype for subsequent launch missions. The bundle technique is considered, including thrust vector variations for attitude control. The development of control automats with error logic is described. The proposed propulsion system consists of six radio frequency ion engines having an ionization chamber diameter of 10 cm (RIT 10). Three of the HF propulsion modules are to be operated with a beam voltage of 4.5 kV and with a specific impulse of 6000 s while the other three modules are to remain in reserve. Optimization and variation possibilities for such a system are analyzed. Transl. by K.W.

N69-31336# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DYNAMIC RESPONSE OF A MACH 2.5 AXISYMMETRIC INLET WITH ENGINE OR COLD PIPE AND UTILIZING 60 PERCENT SUPERSONIC INTERNAL AREA CONTRACTION

Joseph F. Wasserbauer Washington Jul. 1969 61 p refs
(NASA-TN-D-5338) Avail: CFSTI CSCL 21H

The inlet was subjected to sinusoidal bypass area disturbances with frequencies up to 240 hertz and to sinusoidal external disturbances with frequencies up to 15 hertz. Dynamic response data are presented for terminal shock position and selected static pressures throughout the inlet. These results were obtained for the inlet coupled to either an engine or to a cold-pipe configuration. The effect of varying the cold-pipe length and throat bleed configuration are also presented. The dynamic response of the inlet to bypass area disturbances exhibited resonant conditions. The effect of an engine could be simulated with a cold pipe of appropriate length. Author

N69-31463# General American Transportation Corp., Niles, Ill. Research Div.

INVESTIGATION OF NONDESTRUCTIVE TEST METHODS FOR METALLIZED TANK ENGINE CYLINDERS Technical Report, Dec. 1966–Feb. 1968

I. R. Kraska and E. Kubiak May 1968 84 p refs
(Contract DAAE07-67-C-1990)
(AD-686344) Avail: CFSTI CSCL 21/7

The specific objectives for the subject program were to: (1) Study in detail the flame spraying process in order to determine the metallurgical nature of the steel-to-molybdenum bond and the molybdenum itself. (2) Determine, if possible, the actual flaw-producing mechanism. (3) Investigate various nondestructive test (NDT) methods with the purpose of developing a method of detecting flaws and determining the integrity of the flame-sprayed coating. Author (TAB)

N69-31761# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Deputy for Engineering.

EVALUATION OF EFFECTIVENESS OF SPECTROMETRIC OIL ANALYSIS TECHNIQUE FOR MULTIENGINE AIRCRAFT Technical Report, Mar. 1966–Dec. 1967

Donald C. Kittinger Feb. 1969 81 p ref
(AD-686155; ASD-TR-68-58) Avail: CFSTI CSCL 21/5

Probably the most difficult if not impossible item to evaluate in the spectrometric oil analysis programs within DOD is the consequence of things that have not happened. Although losses can be assessed when an undetected engine discrepancy results in an engine failure, losses cannot be assessed when such discrepancy has been detected and corrected by oil analysis before failure occurred. The objective of the task was to evaluate the consequence of not performing maintenance after an oil analysis laboratory predicted engine failure. During the program, 1376 samples were extracted from the C-141/TF-33, 1929 samples from the KC-135/J57-59, and 2458 samples from the B-52/J57-43. The data shows that, although the spectrometric technique is capable of predicting incipient wear on oil-wetted parts prior to part failure, the decisions on the analysis results must be improved to achieve the most effective oil analysis programs. Author (TAB)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N69-30748*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CHARACTERISTICS OF THE X-RAY EMISSIONS ASSOCIATED WITH SOLAR PROTON FLARES

Kunitomo Sakurai (NAS-NRC) Jun. 1969 9 p refs
(NASA-TM-X-63800; X-615-69-269) Avail: CFSTI CSCL 03B

Sudden ionospheric disturbances such as SWF, SEA, SPA and others are usually associated with solar proton flares. These disturbances are generated by enhanced ionization of the lowest part of the ionospheric D region due to the incidence of energetic X-rays. Author

N69-30819*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SOLAR PROTON OBSERVATIONS, 1–10 MeV

D. J. Williams Jun. 1969 44 p refs Presented at the Seminar on the Study of Interplanet. Space Phys. Using Cosmic Rays Leningrad, 4–7 Jun. 1969 Submitted for Publication
(NASA-TM-X-63597; X-612-69-258) Avail: CFSTI CSCL 04A

A brief resume of diffusion models and solar proton propagation in the interplanetary medium is given. Observations of solar protons from the Solar Proton Monitoring Experiment flown aboard the Explorer 34 satellite are then presented. Attention is focused on the 1-10 Mev proton intensities and their different behavioral characteristics as compared to higher energy (> few tens of Mev) solar protons. Observations of quasi-periodic variations in the 1-10 Mev proton intensities are presented. Power spectra are shown for both quiet and active periods. It is found that during the quiet periods analyzed, the 1-10 Mev proton intensity power spectra displayed an f^{-1} to $f^{-1.5}$ trend. Some mechanism is apparently ordering the proton intensities in the frequency domain. Active periods are shown in which prominent peaks in the power spectra are observed at 0.0125 cycles per minute $(2.1)(10)^{-4}$ Hz; 80 minute period) and at 0.02 cycles per minute $(3.3)(10)^{-4}$ Hz; 50 minute period). A summary of observations concerning the entry of low energy protons into the magnetosphere is given. Author

N69-30870*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

RELATIVE HELIUM ABUNDANCE AND PLASMA PROPERTIES IN THE SOLAR WIND

Donald Eugene Robbins (Ph.D. Thesis--Houston Univ.) Jun. 1969 268 p refs
(NASA-TM-X-58031) Avail: CFSTI CSCL 03B

Data obtained on the Vela 3A and 3B satellites between July 1965 and July 1967 were used in this study. The long term average of the helium to hydrogen density ratio was 0.037. Of the 10,314 spectra used, 90% gave He-H ratios between 0.01 and 0.08. Comparisons with "solar surface" relative He abundance measurements were made. The He-H ratios observed were greater than 0.063 only 10% of the time. Mechanisms which allow regions of higher He abundance in the chromosphere and corona are discussed. Large variations of the He-H ratio were observed even when averages over solar rotations were computed. A possible solar cycle dependence of the abundance is suggested. Sudden large increases in the He-H ratio correlate well with Forbush decreases and sudden commencement geomagnetic storms. Theories relating these increases to part of the solar chromosphere blown into the solar wind during flares are discussed. The He and H bulk velocities were found to be virtually equal at all times. The phenomena of "frozen in flux" is used to explain this equality. Solar wind ion species were found to be rarely in thermodynamic equilibrium. The average He temperature was four times the H temperature, indicating that the two ion species have equal velocities. Author

N69-30958*# California Inst. of Tech., Pasadena.

SOLAR X-RAYS SCATTERED BY VENUS, MARS AND THE MOON

E. D. Loh and G. P. Garmire 10 Jan. 1969 17 p refs
(Grant NGL-05-002-007)
(NASA-CR-103215; CIT-XRR-1) Avail: CFSTI CSCL 04A

The important scattering processes for the light elements K or L photoionization with fluorescence, Rayleigh scattering, and Compton scattering are studied in the range of 4Å to 50Å. The Compton scattering is treated as an addition to Rayleigh scattering. The planetary atmospheres are assumed to be plane-parallel layers, and are thick for X-rays. A special coordinate system is defined to describe the surface of the planet. The K fluorescence flux, and the Rayleigh and Compton scattered fluxes are calculated. Numerical results are tabulated. F.O.S.

N69-31004*# Minnesota Univ., Minneapolis. Cosmic Ray Group.
A BALLOON BORNE X-RAY SURVEY OF THE CYGNUS REGION
Charles Peter Reinert (Ph.D. Thesis) Jun. 1969 100 p refs
(Grant NGL-24-005-008)
(NASA-CR-103221; CR-132) Avail: CFSTI CSCL 04A

Localized celestial sources of X-rays are surveyed in the Cygnus constellation by means of balloon-borne detectors. The design of the X-ray detector is described, with consideration given to the background radiation problems. Data from an actual flight are analyzed, and results are discussed. One of the results is an indication of a steepening of the energy spectrum in the vicinity of 100 keV. Tables and charts summarizing the experiment are included. F.O.S.

N69-31557# Naval Research Lab., Washington, D.C.
THE NRL SOLRAD 9 SATELLITE SOLAR EXPLORER B 1968-17A
Robert W. Kreplin and Donald M. Horan 24 Mar. 1969 51 p refs
(AD-686019; NRL-6800) Avail: CFSTI CSCL 3/2

The SOLRAD 9 satellite, launched March 5, 1968, carried instruments to measure solar radiation in the x-ray region from 0.1 to 60 Angstroms and in the far-ultraviolet from 1080 to 1350 Angstroms. These spectral regions are covered by a number of band-sensitive ionization-chamber photometers, Geiger counters, and scintillation counters. An aspect sensor was also included to measure the angle between the solar direction and view direction of the photometers for correction of photometer measurements in case of failure of the attitude-control system. The satellite transmits its x-ray and ultraviolet measurements in real time via an FM/AM telemetry system operating in the 136-MHz band. Author (TAB)

N69-31615 World Meteorological Organization, Geneva (Switzerland).
INCIDENCE, DISTRIBUTION AND WARNING OF SOLAR FLARES AND RADIOACTIVITY
R. W. Knecht *In its* Aeron. Meteorology 1969 p 458-468 refs (See N69-31576 17-20)
Avail: Issuing Activity

The two components of energetic particle radiation that will be experienced at SST altitudes are identified as: (1) galactic, cosmic radiation, and (2) solar flare, proton radiation. The following topics related to these hazards are briefly discussed: galactic cosmic radiation; solar flare climatology; the solar flare phenomenon; predictability of proton flares; electromagnetic characteristics of proton flares; properties of proton radiation; and detection of incoming solar protons. A discussion of the possible operational implications of solar flare radiation, including comments on the kinds of forecast and warning that might be useful is included. Also, the importance of an adequate system of on-board radiation monitoring during the early SST test flights is discussed briefly. Author

N69-31616 World Meteorological Organization, Geneva (Switzerland).
NOTES ON SOLAR FLARE WARNINGS FOR SST AIRCRAFT
F. E. Cook *In its* Aeron. Meteorology 1969 p 469-475 (See N69-31576 17-20)
Avail: Issuing Acitivity

The possible dangers of cosmic rays and solar flare particles to SST passengers and crew, and to some structural materials of the aircraft are discussed in relation to the events which produce them. Some alternative warning systems which might be utilized are treated, based on experience with existing systems and experimental research. The primary concern is with energetic particles (mostly protons with some nuclei of heavier elements and electrons) emitted from the sun during solar flares and reaching the earth's atmosphere some minutes to hours later. Author

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N69-30564 Stanford Univ., Calif.
ORBITS OF NEAR EARTH SATELLITES
Peter Ching-Ming (Ph.D. Thesis) 1968 53 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-253

The equations of motion of a point mass under the influence of the potential V, where J and α are small parameters, is studied in detail. For the case $\alpha = 0$ the equations are solved explicitly. For the general case $\alpha \neq 0$, but with J and α small, periodic solutions are derived. Using a theorem by J. Moser, the existence of invariant manifolds is established. Solutions on these manifolds are almost periodic. Solutions not on the manifolds are constrained to lie between two successive manifolds, and exist for all time. Finally, these same results are extended to more general potentials and in particular to the earth's potential. Dissert. Abst.

N69-30611*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN ANALYSIS OF SATELLITE POSITIONAL UNCERTAINTY BY STATISTICAL MECHANICS
N. L. Bonavito Washington Jul. 1969 15 p refs
(NASA-TN-D-5259) Avail: CFSTI CSCL 22C

This paper treats, from a statistical mechanics viewpoint, the justification for acknowledging satellite positional uncertainty through in-track error buildup. In addition, by relating the angular momentum to a quantity defined as the virial parameter, through a derived quantity defined as the vector density function, it is shown that for any conservative system, the periodic variations, and hence the cross track error, will time average to zero. This is a direct consequence of the conservation of angular momentum. Author

N69-30675*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SUBSYSTEM RADIATION SUSCEPTIBILITY ANALYSIS FOR DEEP-SPACE MISSIONS; A REPORT COVERING TASK 3A EFFORT UNDER THE STUDY OF NASA EVALUATION WITH MODELS OF OPTIMIZED NUCLEAR SPACECRAFT (NEW MOONS)
William S. West, W. Poch (RCA, Princeton, N.J.), A. Holmes-Siedle (RCA, Princeton, N.J.), H. W. Bilsky (RCA, Princeton, N.J.), and D. Carroll (RCA, Princeton, N.J.) Apr. 1969 195 p
(Contract NAS5-10441)
(NASA-TM-X-63591; X-701-69-171) Avail: CFSTI CSCL 22B

Scientific, unmanned spacecraft on missions to Jupiter and beyond will be subjected to nuclear radiation from the natural environment and onboard nuclear power sources which may be harmful to subsystems. This report postulates these environments and discusses practical considerations to assure confidence that the spacecraft's materials and subsystems will withstand the effects of anticipated radiation. Degradation mechanisms are discussed. Author

N69-30678# Lockheed Missiles and Space Co., Sunnyvale, Calif.
PLASMA ENIGMAS (SCIENCE BROADENS THE HORIZON)
K. Gringauz [1968] 3 p Transl. into ENGLISH from Pravda (Moscow), No. 186(18599), Jul. 1969 p 3
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The simultaneous growth in the plasma and magnetic field fluxes noted by spacecraft near planets, primarily Venus, are discussed. The phenomenon was noted by Venera 4, 5, and 6 probes, and Mariner 5 probe. The interplanetary perturbation near earth (with a magnetic field) and Venus (with no magnetic field) are compared. It is pointed out that if the celestial body has no magnetic field the magnetized plasma reaches the surface, and the charged particles are neutralized on the body surface. A rarefied zone, a unique shadow almost deprived of charged particles, is formed behind the body, and no shock wave is produced. The geomagnetic field stops the plasma flux moving from the sun, at about 60,000 km, and produces a shock wave. It is concluded that study of these perturbations offers a means of obtaining new information on the characteristics of planets. F.O.S.

N69-30682# Defence Research Board, Ottawa (Ontario).
ARE THE "SEAS" OF MARS LUNAR SEAS?
M. A. Dauvillier Apr. 1969 4 p refs Transl. into ENGLISH from Ciel et Terre (Belgium), v. 83, No. 11–12, 1967 p 384–385
(T-8-F) Avail: CFSTI

Various theories on the origin of the characteristic topography of planets are reviewed with emphasis on the Moon and Mars. Photographs from the Mariner 4 support the belief that the seas of the Moon are vast quasi-circular dark depressions, while on Mars the dark regions resemble the continental sections of the Moon. The light reddish-colored flat regions of Mars are presented as continental deserts. J.A.M.

N69-30683 Minnesota Univ., Minneapolis
THE SOLAR WIND AND ITS INTERACTION WITH PLANETARY BODIES
Antonio Alfonso-Faus (Ph.D. Thesis) 1968 113 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-17654

The problem of the interaction of the solar wind with the moon is attacked from a kinetic theory point of view. The boundary conditions are the total absorption of the solar-wind particles by the moon's surface and the magnetic transparency of the lunar body; these conditions imply the absence of an upstream shock wave. The analytical treatment of the ion component gives the gross features of the structure of the interaction. The main feature is the presence of an empty cavity of conical shape, that has the length of a few tens of moon radii. This cavity was observed by the satellite Explorer 35. The inclusion of the electron component represents a refinement to the results obtained from the ion treatment. Two important effects are found due to electron pressure: (1) shortening of the length of the wake, and (2) weakening of the gradients of density across the boundary. Dissert. Abstr.

N69-30700*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TECHNIQUES FOR ACHIEVING MAGNETIC CLEANLINESS ON DEEP-SPACE MISSIONS: A REPORT COVERING TASK 3 EFFORT UNDER THE STUDY OF NASA EVALUATION WITH MODELS OF OPTIMIZED NUCLEAR SPACECRAFT (NEW MOONS)
William S. West, J. Michael L. Holman (RCA, Princeton, N.J.), and Herbert W. Bilsky (RCA, Princeton, N.J.) Apr. 1969 91 p refs
(Contract NAS5-10441)
(NASA-TM-X-63592; X-701-69-173) Avail: CFSTI CSCL 03B

Unmanned spacecraft were studied for missions to Jupiter and beyond that will obtain scientific data including measurements of magnetic fields in interplanetary space. Descriptions are given of engineering considerations associated with design, development, and test of spacecraft and subsystems thereof that achieve sufficiently low levels of magnetic interference levels at the magnetometers to permit scientific measurement. Engineering methods and data are provided for selecting different background interference values, with 0.1 gamma being the value selected for illustration purposes. Unique magnetic considerations associated with nuclear power supplies are covered. Author

N69-30752*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANALYSIS OF SELECTED DEEP-SPACE MISSIONS: A REPORT COVERING TASK 1 EFFORT UNDER THE STUDY OF NASA EVALUATION WITH MODELS OF OPTIMIZED NUCLEAR SPACECRAFT (NEW MOONS)
William S. West, J. Michael L. Holman (RCA, Princeton, N.J.), and Herbert W. Bilsky (RCA, Princeton, N.J.) Apr. 1969 144 p refs
(Contract NAS5-10441)
(NASA-TM-X-63590; X-701-69-170) Avail: CFSTI CSCL 22A

This report covers an analysis of selected deep-space missions and includes an introduction to considerations of launch vehicles, spacecraft, spacecraft subsystems, and scientific objectives associated with precursory unmanned missions to Jupiter thence out-of-the ecliptic plane as well as other missions to Jupiter and other outer planets. Necessity for nuclear power systems is indicated. Trajectories are developed using patched conic and n-body computer techniques. Author

N69-30786*# Artec School of Languages, Inc., Maynard, Mass.
INVESTIGATIONS OF PROJECTILE MATERIAL IN MICROCRATERS [UNTERSUCHUNGEN DES PROJEKTILMATERIALS IN MIKROKRATERN]
Gerhard Neukum Washington NASA Jun. 1969 53 p refs Transl. into ENGLISH of a Max-Planck-Inst. fuer Kernphys. publ., Jan. 1969 p 1–46
(Contract NASw-1692)
(NASA-TT-F-12327) Avail: CFSTI CSCL 03B

The remains of the projectile material of artificially accelerated Fe microprojectiles were investigated as a function of projectile parameters, mass m, and velocity v in the range 3.5×10^{-10} g $\leq m \leq 3 \times 10^{-13}$ g and 0.2km/s $\leq v \leq$ 12.6 km/s. The materials Al, Cu, Ag, Cd, Ta, and W were used as targets. The targets Al, Cu, and W were systematically evaluated. A new method is described which was developed for the purpose of measuring residual projectile mass in the craters by means of X-ray microanalysis: the scanning method. By this method, the electron beam of the microprobe scans a defined area in which the projectile microquantity lies. The characteristic relative X-ray intensity line obtained over a scanning cycle (referred to as a standard intensity) is a measure of the mass. Author

N69-30787# Lowell Technological Inst. Research Foundation, Mass.

RESEARCH DIRECTED TOWARD THE DESIGN AND FABRICATION OF A SOLAR ATMOSPHERIC DISHPAN EXPERIMENT Final Report, 1 Apr. 1963–30 Sep. 1968

Edward S. Gilfillan, Kenneth V.L. Rogers, and John H. Wheaton Mar. 1968 55 p refs

(Contract AF 19(628)-2837)

(AD-675644; LTIRF-273/IP; AFCRL-68-0177) Avail: CFSTI CSCL 3/2

The motion of a conducting fluid confined within the annular space between two rotating concentric cylinders and subjected to an approximately radial temperature gradient was studied as a function of: the angular velocity of the cylindrical system, the applied annular temperature gradient and the radius of the inner cylinder. Both single lobe Hadley regimes and multiple lobe Rossby regimes were observed. The results of each experiment (with a given radius of the inner cylinder) are presented as a two-dimensional field map in which the observed lobe number is mapped at measured points in the angular velocity-temperature gradient field. Additional fluid motion experiments were performed to study the effects on these results of reversing the temperature gradient, applying a magnetic field parallel to the axis of rotation, employing various fluids and changing the geometry of the outer and inner surfaces (in contact with the fluid). Again, Hadley and Rossby regimes were observed in many cases. Author (TAB)

N69-30812*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ANALYSIS OF THE PERTURBATIONS IN THE ANGULAR ORBITAL ELEMENTS FOR THE SATELLITE RELAY 2

Victor T. Laczo (M.S. Thesis—Georgetown Univ.) Jun. 1969 84 p refs

(NASA-TM-X-63598; X-552-69-262) Avail: CFSTI CSCL 22C

The solution to the problem of describing an actual satellite's orbit is approached either numerically or by use of an infinite series technique. The use of such methods still leaves the Keplerian elements as suitable quantities with which to solve problems but their use can occasionally cause difficulties. One such difficulty arises when one attempts to describe the motion of the artificial satellite Relay 2. The period of an argument of the motion, the longitude of perigee, is about 570 years. This condition is referred to as resonance. Resonance complicates the computations of the Keplerian angular elements ω and Ω for Relay 2. The series expressions for ω and Ω have some lunisolar terms which have the derivative of the longitude of perigee in the denominator. This work shows the feasibility of an approach to treat the angular orbital elements ω and Ω for Relay 2. The approach numerically integrates Lagrange's planetary equations and thereby bypasses forming terms which have the derivative of the longitude of perigee in the denominator. By using this method, one avoids all near singular terms which cause large errors. Author

N69-30814*# Massachusetts Univ., Amherst. Dept. of Physics and Astronomy.

SOLAR LIMB DARKENING IN THE FAR INFRARED AND ITS RELATION TO THE TEMPERATURE OF THE CHROMOSPHERE Final Report, 1 Sep. 1967–31 Aug. 1968

William G. Mankin 31 Aug. 1968 183 p refs

(Contract NGR-22-010-025)

(NASA-CR-103213; Contrib-46/242) Avail: CFSTI CSCL 03B

A balloon-borne telescope and filter radiometer has been used to observe the limb darkening of the sun at six infrared wavelengths ranging from 11 to 115 μ in order to determine the variation of electron temperature with height in the lower chromosphere. It is shown that the only important source of far infrared opacity in the lower chromosphere is the free–free transitions of negative hydrogen, for which the absorption coefficient is proportional to the square of the wavelength, and further that the source function in the far infrared is just the Planck function of the local electron temperature. Under the circumstances the infrared brightness temperature, except for a small correction for departures from the Rayleigh–Jeans law, is a function only of λ^2/μ, where λ is the wavelength and μ, the cosine of the zenith angle on the sun. Therefore, the solar infrared spectrum may be deduced from limb darkening measurements. Author

N69-30823*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MULTI-EXPERIMENT DETECTION OF THE PLASMAPAUSE FROM EOGO SATELLITES AND ANTARCTIC GROUND STATIONS

D. L. Carpenter (Stanford Univ.), C. G. Park (Stanford Univ.), H. A. Taylor, Jr., and H. C. Brinton Sep. 1968 24 p refs Sponsored in part by NSF

(Contract NAS5-2131)

(NASA-TM-X-63602; X-621-68-365) Avail: CFSTI CSCL 04A

Three independent methods of detecting the plasmapause have been compared: (1) ion mass spectrometers on OGO 1 and OGO 3; (2) broadband VLF receivers (0.3–12.5 kHz) on OGO 1 and OGO 3; and (3) broadband VLF receivers at ground stations in Antarctica near the 90°W meridian. In the satellite VLF data the plasmapause crossings are identified by abrupt changes in observed whistler and VLF noise activity, and by noise bands of limited duration. In two cases of simultaneous VLF and ion data from the same EOGO satellite, plasmapause crossings were detected by both experiments within less than $0.1R_E$ in L value. In eight cases of OGO 1 ion data and simultaneous ground whistler data spaced from 1 to 12 hours from OGO 1 in local time, good agreement was found between the measured plasmapause positions. The comparisons provide new verification of the essentially worldwide extent of the plasmapause, and also verify previous indications that the radius of the plasmapause is frequently about constant over large local-time sectors. Author

N69-30892 Maryland Univ., College Park.

PHYSICAL PROPERTIES AND DYNAMICS OF INTERPLANETARY DUST

Lothar Wilhelm Bandermann (Ph.D. Thesis) 1968 324 p

Avail: Univ. Microfilms: HC $14.65/Microfilm $4.15 Order No. 69-710

The physical properties and the distribution of dust in interplanetary space are derived from a study of satellite impact rates, of the zodiacal isophots, and of deep sea deposits. These data are shown to be self-consistent and compatible with a typically flat size distribution such as given by van de Hulst, for which the mean particle radius is 2.7 microns, the spectral index is $p = 2.6$, and the dust concentration at 1 AU (in the ecliptic plane) is 5.5×10^{-14}cm^{-3}. The particles have rather smooth surfaces and are stoney and compact. The dust mass per unit volume at 1 AU is equal to 3.4×10^{-21} gm/cm^3, based on the van de Hulst distribution. Important information concerning the size of dust particles and their orbital elements could be derived from observations of asymmetries in influx of dust into the earth's atmosphere and in satellite impact rates. However, present data are scant and inconclusive. Dissert. Abstr.

N69-31007# Northeastern Univ., Boston, Mass.

A FORTRAN PROGRAM TO GENERATE TIME VS SOLAR DEPRESSION TABLES

Allan R. Zeiner 31 Jan. 1969 29 p refs

(Contract AF 19(628)-5731)

(AD-686472; AFCRL-69-0090) Avail: CFSTI CSCL 3/1

A program is presented for the generation of tables of solar depression versus time on a particular day or period of days for any location. The input data required are two values for each day and the value of delta T for the year as taken from The American Ephemeris and Nautical Almanac, the longitude and latitude of the location of interest, the maximum and minimum zenith angle desired. The program is suitable for or easily adapted to any first generation or newer computer capable of being programmed in Fortran. Author (TAB)

N69-31058*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE PIONEER 8 COSMIC DUST EXPERIMENT
Otto E. Berg and F. Frank Richardson Washington Jul. 1969 14 p
(NASA-TN-D-5267) Avail: CFSTI CSCL 14B

A cosmic dust sensor comprising a unique array of sensor, sensor controls, and in-flight calibrations was placed in a heliocentric orbit (0.99 to 1.088 a.u.) on December 13, 1967, on board the Pioneer 8 satellite. The ionization and momentum imparted by the impact of a cosmic dust particle upon a surface are measured by the sensor to determine the particle's direction, speed, and mass. Prelaunch calibration studies using the Goddard Space Flight Center electrostatic accelerator have shown that the sensors can measure kinetic energies of impacting particles as low as 0.6 erg and momenta as low as 2×10^{-5} dyne-sec. Author

N69-31189# Defence Research Board, Ottawa (Ontario). Defence Scientific Information Service.
SPECTRAL INHOMOGENEITIES OF THE LUNAR SURFACE IN THE MIDDLE ULTRAVIOLET, FROM THE DATA OF AUTOMATIC INTERPLANETARY STATION "ZOND 3"
M. U. Aganina et al May 1969 7 p refs Transl. into ENGLISH from Astron. Vestn. (USSR), v. 3, no. 1, 1969 p 14–17
(T-520-R) Avail: CFSTI

The color inhomogenities of the far side of the moon are studied, using measurements made from the Automatic Interplanetary Station, Zond 3. The investigated region of the moon subdivides, according to mean brightness, into three distinct fields. The maximal color contrasts between individual areas studied amount to 24%; the mean color-contrasts 10%. Author

N69-31182# National Center for Atomspheric Research, Boulder, Colo.
NCAR RESEARCH AND FACILITIES PROGRAMS Annual Report, 1968
May 1969 213 p refs Sponsored by NSF
(AR-7) Avail: Issuing Activity

Studies undertaken by the National Center for Atmospheric Research (NCAR) are reported. Two major fields of activity are emphasized: (1) programs related to the Global Atmospheric Program, including continued development of mathematical models of the global circulation, research in tropical meteorology, the GHOST balloon program, and a number of national and international planning efforts; and (2) studies of the nature of severe convective storms, with emphasis on hailstorms. Author

N69-31215# Defence Research Board, Ottawa (Ontario). Scientific Information Service.
VERIFICATION OF THE HYPOTHESIS OF A MARTIAN LIMONITIC COVER
I. I. Lebedeva et al May 1969 10 p refs Transl. into ENGLISH from the Publ. "Voprosy Astrofiziki" Kiev, Naukova Dumka Press, 1965 p 99–109
(T-521-R) Avail: CFSTI

CONTENTS:

1. VERIFICATION OF THE HYPOTHESIS OF A MARTIAN LIMONITIC COVER. FROM SPECTROPHOTOMETRIC DATA. I. I. Lebedeva p 1–5 refs (See N69-31216 17-30)

2. VERIFICATION OF THE HYPOTHESIS OF A MARTIAN LIMONITIC COVER. BY INDICATOMETRY T. D. Bessonova p 6–9 refs (See N69-31217 17-30)

N69-31216# Defence Research Board, Ottawa (Ontario). Scientific Information Service.
VERIFICATION OF THE HYPOTHESIS OF A MARTIAN LIMONITIC COVER FROM SPECTROPHOTOMETRIC DATA
I. I. Lebedeva *In its* Verification of the Hypothesis of a Martian Limonitic Cover May 1969 p 1–5 refs (See N69-31215 17-30)

Photospectrometric studies were performed, and these results on the comparative optical properties of the Martian continent and terrestrial rocks are presented. From published observations, three curves of the spectral distribution of light intensity were constructed for: (1) geometric albedo, (2) apparent albedo of continents, and (3) true albedo of continents. Similarities of terrestrial materials were investigated in the infrared and ultraviolet spectra. Spectrophotometric data lend support to the hypothesis concerning the presence of limonite on the surface of Mars. J.A.M.

N69-31217# Defence Research Board, Ottawa (Ontario). Scientific Information Services.
VERIFICATION OF THE HYPOTHESIS OF A MARTIAN LIMONITIC COVER BY INDICATOMETRY
T. D. Bessonova *In its* Verification of the Hypothesis of a Martian Limonitic Cover May 1969 p 6–9 refs (See N69-31215 17-30)
Avail: CFSTI

Lambert's law of cosines is presented for the orthotropic reflection of the surface of Mars. Materials were examined that closely resembled those on Mars. Indicatrices of reflection of red soils, limonite (lumps and powder), and terra rosa samples were obtained by the use of a large indicatometer. Indicatrices were measured up to the angle of 80°. The results from these studies of brightness coefficient and color index values near those of the Martian surface, add support to the belief that the Martian surface is composed of limonite dust or a powdery substance pigmented with limonite. J.A.M.

N69-31294*# Aztec School of Languages, Inc., Maynard, Mass.
THE SPEED OF TURBULENT MOTION IN THE SOLAR PHOTOSPHERE [O SKOROSTI TURBULENTNYKH DVIZHENIY V FOTOSFERE SOLNTSA]
D. M. Kuli-Zade Washington NASA Jul. 1969 11 p refs Transl. into ENGLISH from Tr. Astron. Observ. (Leningrad), v. 25, no. 337, issue 42, 1968 p 46–53
(Contract NASw-1692)
(NASA-TT-F-12294) Avail: CFSTI CSCL 04A

The speeds of turbulent motions in the solar photosphere are found by three methods. Using correlation curves it was found that the speeds of microturbulent motions increase from the center to the limb of the solar disk. The speed of macroturbulent motions as determined from the central depths of Fraunhofer lines is equal to 2.21 km/sec at the center of the disk and to 2.18 km/sec at the limb. The study of line profiles leads to the conclusion that for $0.0 < To < 0.2$ the speeds of the turbulent (macro + micro) motions increase with depth. Author

N69-31345*# Michigan Univ., Ann Arbor. Dept. of Astronomy.
RESULTS FROM ORBITING GEOPHYSICAL OBSERVATORY 1 Final Scientific Report
Fred T. Haddock [1969] 6 p
(Contract NAS5-2051)
(NASA-CR-103321) Avail: CFSTI CSCL 03A

The OGO-1 spacecraft encountered difficulties shortly after launch and the antenna erection command for this instrument was delayed for some time. When the erection attempt was made the the antenna only erected an estimated four to six feet instead of the intended 30 feet. The complete shutdown of the experiment was not requested since there existed a chance that a very large solar flare event would be observed with the greatly reduced antenna sensitivity. However, reduction of the data tapes for 1/1/66, 3/19/66, and 3/25/66 have yielded nothing. Data tape reduction was delayed by computer costs. This experiment was finally judged a scientific failure. The OGO-3 (OGO-B) experiment performed satisfactorily and provided good scientific results. Author

N69-31355*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
THE INFLUENCE OF SYSTEMATIC ERRORS OF NATURAL MOTIONS AND OF THE SECULAR MOTION OF THE POLE ON RESULTS IN DETERMINING THE SECULAR VARIATIONS OF LONGITUDE [O VLIYANII SISTEMATICHESKIKH OSHIBOK SOBSTVENNYKH DVIZHENIY I VEKOVOGO DVIZHENIYA POLYUSA NA REZUL'TATY OPREDELENIYA VEKOVOGO IZMENENIYA DOLGOT]
K. V. Dobretsova Washington NASA Jul. 1969 7 p refs Transl. into ENGLISH from Rusaian Rept.
(Contract NASw-1692)
(NASA-TT-F-12299) Avail: CFSTI CSCL 03A

The influence of systematic errors of natural motions, and of the secular motion of the pole on results in determining the secular variations of longitude is investigated. Different methods employed by modern time services are taken into account. Author

N69-31362*# Michigan Univ., Ann Arbor.
ANALYTICAL SOLUTIONS OF A CLASS OF OPTIMUM ORBIT MODIFICATIONS
Nguyen X. Vinh and Christian Marchal Washington NASA Jul. 1969 37 p refs
(Contract NASr-54(06))
(NASA-CR-1379) Avail: CFSTI CSCL 22C

A complete analytical solution of several fundamental problems in orbital corrections is presented. The initial orbit is represented by a given point in the phase space while the final orbit is constrained to stay in a given curve which can be bounded, unbounded, or is composed of a finite number of segments of different curves. The inclusion of atmospheric maneuver as part of the optimum process is discussed, and its analytical treatment can be carried out by modifying the final state to include the set of orbits having their perigees at the boundary of the atmosphere. The selection of the apogee and perigee distances as state variables gives a symmetric form to the problem and results in a linear differential equation of the first order for the ratio of the adjoint variables. The introduction of a curve of comparison, called the separatrix, facilitates the discussion of the existence of a corner on an optimal trajectory. Author

N69-31383*# New Mexico State Univ., Las Cruces. Observatory.
A THREE-MONTH OSCILLATION IN THE LONGITUDE OF JUPITER'S RED SPOT
H. Gordon Solberg, Jr. Jan. 1969 15 p refs
(Grants NGL-32-003-001; NGR-32-003-027)
(NASA-CR-103314; TN-701-69-27) Avail: CFSTI CSCL 03A

Photographic measurements of Jupiter's Red Spot show that it oscillated semiregularly between 1963 and 1968; the oscillation had a mean period of 90.0 days and a mean amplitude of 0°.8. No comparable oscillation has ever been observed in the Jovian atmosphere. Author

N69-31394*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
OUTER SPACE AND CIVIL AVIATION [KOSMOS I GRAZHDANSKAYA AVIATSIYA]
V. Denisov et al Washington NASA Jun. 1969 5 p Transl. into ENGLISH from Grazhdenskaya Aviatsiya (Moscow), no. 4, 1969 p 13-14
(Contract NASw-1692)
(NASA-TT-F-12434) Avail: CFSTI CSCL 22A

A study is presented on how advances in outer space and civil aviation are giving each other further impetus so that countless fields of science and technology might be reinforced and expanded. Author

N69-31481# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
ASTROPHYSICAL APPLICATIONS OF LINE SHAPES
J. Cooper Sep. 1968 18 p refs Sponsored in part by ARPA
(AD-686397; JILA-98) Avail: CFSTI CSCL 3/2

In this paper an attempt is made to summarize and put into perspective the needs of astronomers for line broadening data. Author (TAB)

N69-31574*# Radio Corp. of America, Princeton, N.J.
ATMOSPHERIC TURBULENCE ON VENUS: EVIDENCE FOR SEVERE MICROWAVE SIGNAL FADING FROM VENERA 4
D. A. deWolf [1968] 9 p refs
(Contract NAS2-5310)
(NASA-CR-73346) Avail: CFSTI CSCL 03A

Mild fading of 1 GHz signals from the USSR probe Venera 4 is reanalyzed to yield a turbulence macroscale $L_0 \approx 10$-40 m/sec and dielectric permittivity variance $\epsilon^2 > 10^{-7}$ at 25 km above the surface of Venus. These values and the known steady-state conditions imply severe fading of radio communications at GHz frequencies in the lower Venusian atmosphere. Author

N69-31749# Lockheed Missiles and Space Co., Palo Alto, Calif.
STRUCTURAL PECULIARITIES OF THE MILKY WAY AT LONGITUDES 338-22 DEG
V. I. Kuznetsov [1968] 6 p refs Transl. into ENGLISH from Vopr. Astrofiz., Astrometriia Astrofiz. (Kiev), no. 3, 1968 p 109-117
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Investigations concerning the Milky Way construction are presented. According to the results given, there is a dust barrier between Sagittarius and Carina–Cygnus spirals and the dust terminates in the 18° to 22° longitudes. Comparing the position of the O-B3 stars with the neutral hydrogen distribution, it is noted that the Sagittarius hydrogen branch is shifted relative to the stellar branch. It was noted that the locations of elevated stellar density corresponds to the greatest concentration of dust matter. The data were studied by means of absorption curves of the area under investigation. E.H.W.

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N69-30411# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ANGLE-OF-ATTACK CONVERGENCE AND WINDWARD-MERIDIAN ROTATION RATE OF ROLLING REENTRY VEHICLES
Daniel H. Platus 8 Jan. 1969 50 p refs
(Contract F04701-68-C-0200)
(AD-685154; TR-0200(4240-30)-3; SAMSO-TR-68-53) Avail: CFSTI CSCL 16/4

A simple expression is derived for the influence of roll acceleration on the angle-of-attack convergence of rolling reentry vehicles with pitch or yaw damping. Also included is an analysis of the windward-meridian rotation rate of the rolling vehicle, which is coupled through the gyroscopic equations of motion to the angle of attack and roll rate. It is found that two modes of motion exist for which the windward meridian is generally oscillatory in one mode and rotary in the other (i.e., the vehicle either oscillates about its roll axis relative to the wind or rotates continuously in one direction). The mode of motion depends on the initial reentry conditions, and it is shown that a roll-induced instability can occur whereby the motion changes from the oscillatory mode to the more stable rotary mode. The analytical approximations are compared with computer solutions of the complete equations of motion.
Author (TAB)

N69-30831*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL LATERAL BENDING DYNAMICS OF THE ATLAS-CENTAUR-SURVEYOR LAUNCH VEHICLE
Robert P. Miller and Theodore F. Gerus Washington Jul. 1969 24 p refs
(NASA-TM-X-1837) Avail: CFSTI CSCL 22B

A series of full-scale dynamic tests was conducted to determine the lateral bending dynamics of the launch vehicle. The tests were made at several simulated flight times to obtain a good experimental definition of the vehicle dynamic response in the bending mode frequency range. Parameters measured were bending mode frequencies, damping, mode shapes, and linearity. The bending mode frequencies measured ranged from 2.59 to 31.9 Hz. Damping measured averaged about 2.0 percent of critical. Mode shapes were well defined and continuous in the lower-frequency modes but indicated discontinuities in the higher modes. The modal response was very linear over the excitation range chosen, and only small differences between pitch and yaw axes were seen. Phase relations of various response points for three modes were also measured.
Author

N69-30879 Oregon State Univ., Corvallis.
A STUDY OF ATTITUDE STABILITY OF A SYMMETRICAL SATELLITE IN A CIRCULAR ORBIT
Hsien-Tsan Wang (Ph.D. Thesis) 1967 96 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-466

A model for analytical study of the attitude stability of an orbiting satellite consists of a rigid body whose mass center is constrained to move at constant speed in a circular path about the center of an inverse-square force field. The body is assumed to have one axis of inertial symmetry. It is of primary interest here to determine whether the attitude of this symmetric axis is stable in its various equilibrium positions. The stability depends upon two parameters: the ratio of spin velocity about the symmetry axis to orbital angular velocity, and the ratio of the two moments of inertia of the satellite. The equations of motion which govern the deviations of the symmetry axis from its equilibrium configuration are nonlinear in nature. When linearized, the equations show instability in some regions, but everywhere else, the linear approximation is a critical case in which the roots of the characteristic equation all have zero real part.
Dissert. Abstr.

N69-30821*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACECRAFT PERFORMANCE ANALYSIS
C. V. Judge, P. A. Villone, and W. A. Mecca May 1969 49 p refs
(NASA-TM-X-63593; X-260-69-202) Avail: CFSTI CSCL 22B

The performance lives of a random sample, and of one year design spacecraft, are examined in an effort to provide information concerning useful life of a spacecraft system exclusive of experiment performance.
Author

N69-30884*# McDonnell-Douglas Astronautics Co., St. Louis, Mo. Eastern Div.
ANALYSES AND LIMITED EVALUATIONS OF PAYLOAD AND LANDING SYSTEM STRUCTURES FOR INTERMEDIATE TYPE PLANETARY LANDERS
O. R. Otto, D. J. Dorr, C. D. Goodman, and R. M. Laurenson Washington NASA July 1969 370 p refs
(Contract NAS1-8137)
(NASA-CR-66791) Avail: CFSTI CSCL 22B

A description is given of structural design and six degrees of freedom loads and motions computer programs developed for investigation of planetary landers in the intermediate landing load factor range (50 to 300 earth g units). Limited evaluations of the landing characteristics of crusable torus and inflatable torus lander concepts were conducted employing the computer programs. Both the crushable torus and the inflatable torus structural design programs were shown to be capable of satisfactorily establishing configurations for specified criteria. Utilizing baseline configurations established with the structural design programs, the capability of the landing loads and motions programs to predict six degrees of freedom motions was demonstrated.
Author

N69-30884# RAND Corp., Santa Monica, Calif.
GENERAL SOLUTION FOR THE EQUILIBRIA OF ORBITING GYROSTATS SUBJECT TO GRAVITATIONAL TORQUES
Robert W. Longman and Robert E. Roberson (Calif. Univ., La Jolla, Calif.) Aug. 1968 35 p refs
(AD-675979; P-3915) Avail: CFSTI CSCL 22/2

Three special classes of equilibrium orientations of orbiting gyrostats subject to gravitational torques have been treated in the literature. Considering the internal angular momentum of the gyrostat to be variable in direction and magnitude, we find here all possible equilibria both for the restricted problem (where the effect of spacecraft attitude on the translational equations is ignored) and for the unrestricted problem. The matrix equation which must be satisfied for an equilibrium is put in a particularly illuminating form, from which is found a simple necessary and sufficient condition that an orientation can be made an equilibrium orientation by proper choice of the internal angular momentum vector. It is found that there is a two-parameter family of such orientations. In particular, if the parameters are chosen to describe the direction of the geocentric vertical with respect to principal axes in the body, then one obtains a unique equilibrium orientation for each direction so chosen. A simple geometric visualization of all solutions is presented in these terms. Also, a fourth special class of equilibria is discussed in which the body axis of intermediate moment of inertia lies in the orbital plane.
Author (TAB)

N69-31260# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ARTIFICIAL SATELLITE TRACKING, 1957–1967
A. G. Masevich et al Sep. 1968 88 p refs Transl. into ENGLISH from Nablyudeniya Iskusstv. Sputnikov Zemli, (USSR), no. 6, 1967 p 1–80
(AD-684833; FTD-HT-23-856-68) Avail: CFSTI CSCL 22/3

Contents: Ten years of international cooperation in the field of optical tracking of artificial earth satellites; The history of

synchronous satellite tracking; The scientific use of quasi-synchronous visual satellite tracking data; Investigations based on photometric satellite tracking; Facts and figures. TAB

N69-31320*# Techtran Corp., Glen Burnie, Md.
FEATURES OF THE TELEMETRY SYSTEM OF THE ESRO-1/AURORAE SATELLITE [PARTICULARITES DU SYSTEME DE TELEMESURE DU SATELLITE ESRO-1/AURORAE]
J. Toussaint Washington NASA Jul. 1969 15 p refs Transl. into ENGLISH from French Journal
(Contract NASw-1695)
(NASA-TT-F-12355) Avail: CFSTI CSCL 22B

The telemetry system of the Aurora satellite is described. The PCM transmission was selected to carry the 22 digital, 8 analog, and 68 secondary channels. Resolution requirements and resulting required throughout capacity are outlined. The circuits are described and photographs are presented. Types of modulation used in lower rate channels are described. Author

N69-31387*# National Aeronautics and Space Administration, Washington, D.C.
OGO-F
2 Jun. 1969 36 p
(NASA-News-Release-69-81) Avail: NASA Scientific and Technical Information Division CSCL 22B

The last observatory of the Orbiting Geophysical Observatory (OGO) Program, OGO-F, was scheduled for launch into a low altitude, nearly polar orbit from the Western Test Range, Lompoc, Calif., no earlier than June 5, 1969. The launch of OGO-F marked the final phase of an era of large automated satellite studies of the nature and variability of the earth's near space environment under the influence of the sun. Planned for the period of maximum sunspot activity, the OGO-F mission will investigate the earth's upper atmosphere and ionosphere, the auroral regions surrounding the poles, and the edges of the regions of trapped radiation. Particular emphasis will be placed on the interrelationships between particle activity, aurora and airglow, the geomagnetic field, the neutral and ionized composition, wave propagation and noise, and the input solar energy contributing to ionization and heating. Author

N69-31487# Environmental Data Service, Silver Spring, Md.
CATALOG OF METEOROLOGICAL SATELLITE DATA: ESSA 3 TELEVISION CLOUD PHOTOGRAPHY. PART 1: 4 OCTOBER–31 DECEMBER 1966
1968 112 p refs *Its* Doc. No. 5.313
Avail: SOD $0.75

Maps and tabulated listings giving identifying information on the pictures taken by ESSA 3 during this period are presented. The maps show the area covered by each listed sequence. Nephanalyses of the cloud content of the pictures have been manually reproduced on the maps and are identified with date, track number, and equator crossing number. K.W.

N69-31488# Environmental Data Service, Silver Spring, Md.
CATALOG OF METEOROLOGICAL SATELLITE DATA: ESSA 3 TELEVISION CLOUD PHOTOGRAPHY. PART 2: 1 JANUARY–31 MARCH 1967
31 Mar. 1967 211 p refs *Its* Doc. No. 5.313
Avail: SOD $1.50

Digitized cloud maps replace in this issue the manually constructed nephanalyses used in previous catalogs. The listings identifying the pictures taken by ESSA 3 during this period remain in the same format. There are two maps for each day: the first polar stereographic projection in each set is for the Northern Hemisphere, the second for the Southern Hemisphere. K.W.

N69-31626*# National Aeronautics and Space Administration, Washington, D.C.
APOLLO 11 LUNAR LANDING MISSION: PRESS KIT
6 Jul. 1969 257 p
(NASA-News-Release-69-83K) Avail: NASA Scientific and Technical Information Division CSCL 22B

Preflight information of the Apollo 11 manned lunar landing mission includes mission profile, recovery and quarantine procedures, spacecraft and launch vehicle design information, and crew data. The prime mission objective is to perform a manned lunar landing and return. During their 22-hour stay on the lunar surface, two astronauts will spend up to 2 hours and 40 minutes outside the lunar module gathering samples of lunar surface material and deploying scientific experiments for transmitting data on the lunar environment back to earth. One experiment measures moonquakes and meteoroid impacts on the lunar surface, while the other is a sophisticated reflector that will mirror laser beams back to points on Earth to aid in expanding scientific knowledge both of this planet and the moon. A plaque signed by President Nixon and the crew and an American flag will also be left on the lunar surface. Tracking and data systems information, principal investigators and investigation of the lunar surface samples, and project personnel and contractors are provided. S.P.G.

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N69-30441 Stanford Univ., Calif.
LAMINAR FILM CONDENSATION ON A FINITE HORIZONTAL SURFACE
Bruce Glen Nimmo (Ph.D. Thesis) 1968 185 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-267

An analytical and experimental investigation was conducted on laminar film condensation on a flat isothermal plate normal to body or inertial forces. The controlling thermal resistance in the condensation process is assumed to be that of the condensate film. Theoretical solutions are presented for the condensate film profile and local and mean film heat transfer coefficients. For negligible surface tension effects the mean Nusselt number on the plate is found to be a function of the Sherwood number, and the normalized film thickness at the plate edge, η_{min}. Analytical methods are developed for predicting η_{min} and it is found that its numerical value is such that, over a wide range of practical operating conditions, the dependence of the Nusselt number on η_{min} is very weak. For engineering design purposes an equation giving Nusselt number as a function only of Sherwood number may be used. Dissert. Abstr

N69-30442# Aerospace Corp., El Segundo, Calif. Lab. of Operations.
INFLUENCE OF CONCENTRATED LATERAL LOADS ON THE ELASTIC STABILITY OF CYLINDERS IN BENDING

S. Okubo, J. S. Whittier, and P. E. Wilson 15 Dec. 1968 30 p refs
(Contract F04701-68-C-0200)
(AD-685153; TR-0200(9990)-1; SAMSO-TR-69-55) Avail: CFSTI CSCL 13/13

The character of the instability and the degradation of the moment-carrying capacity are found by Mylar model experiments for cylinders in bending when subjected to concentrated lateral loads. Lateral loads can seriously degrade the moment capability of cylinders. Critical combinations of moment and lateral load cause two distinct modes of failure - collapse and snapping. Collapse modes exhibit buckles which cover the compression half of the cylinder and are critical for large values of moment and small values of lateral load. Snapping modes of failure involve a single dimple and exist for smaller values of moment and larger values of lateral load. Author (TAB)

N69-30449 Washington Univ., Seattle.
THE ANALYSIS OF CLASSICAL PLATE BENDING PROBLEMS USING AN EQUILIBRIUM FINITE ELEMENT MODEL
Richard Thomas Schwaegler (Ph.D. Thesis) 1968 125 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-1214

The general formulation of a true equilibrium finite element model for solving the plate bending problem is described. The only restriction placed on the use of this model as presented here is the restriction to the classical Kirchhoff plate bending theory for small deflections of thin plates. There are no restrictions on the geometry of the plate, the loading conditions, or the elastic constants of the plate material. The model proposed is capable of handling both mechanical and geometrical boundary conditions with equal facility. The theory of equilibrium finite element models for plate bending is first developed. This follows along the lines of the development of Hartz and Watwood for plane stress problems. A consistent equilibrium model based entirely upon the principle of minimum complementary energy is used. This approach avoids any kinematic assumptions. Dissert. Abstr.

N69-30550 Stanford Univ., Calif.
THE AXISYMMETRIC BUCKLING OF INITIALLY IMPERFECT COMPLETE SPHERICAL SHELLS
Tatsuzo Koga (Ph.D. Thesis) 1968 140 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-242

In the analysis, the complete spherical shell is divided into two parts: the shallow cap in which the initial imperfection exists, and the remaining portion of the shell most of which deforms in simple contraction. The rotation of the meridian of the cap is assumed in the form of a polynomial function. Four matching conditions are enforced at the juncture of the cap and remainder. The total potential energy of the complete spherical shell is minimized in accordance with the Rayleigh–Ritz approximation method. Two types of initial imperfections are studied: one is an axisymmetric dimple, and the other is a spherical region whose radius of curvature is greater than that of the perfect spherical shell. It follows then that the buckling pressure of the practical complete spherical shell is reduced to two-thirds and one-third of the classical buckling pressure when the imperfection amplitude is one-tenth and one-half of the wall-thickness, respectively. Dissert. Abstr.

N69-30596 Northwestern Univ., Evanston, Ill.
AXIALLY SYMMETRIC LONGITUDINAL VIBRATIONS OF FINITE CIRCULAR CYLINDERS
Melvyn Lewis Rumerman (Ph.D. Thesis) 1968 131 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 69-1924

An approximate method is used to study the free, axially symmetric longitudinal vibrations of circular cylinders of finite length. The technique consists of expressing the radial and axial components of displacement in Fourier–Bessel series of the pure radial and axial modes of the infinite cylinder, respectively. These pure modes are exact solutions of the equations of motion and lateral boundary conditions when the displacements do not depend on the axial coordinate (infinite wavelength). A set of differential equations for the coefficients of the expansion functions is derived by a Galerkin-type procedure using the stress equations of motion. By changing the values of certain parameters which appear, these equations may be applied to solid or hollow cylinders with any type of homogeneous boundary conditions of the lateral surfaces. Dissert. Abstr.

N69-30596 Stanford Univ., Calif.
TRANSVERSE VIBRATIONS OF SPINNING DISCS AND STRIPS
Allan Irving Krauter (Ph.D. Thesis) 1968 86 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-246

Free transverse vibrations of thin discs and rectangular strips are investigated. Each is rotating with constant speed about an axis perpendicular to its undeflected middle surface and through its centroid. Nonlinear equations are written so that they govern transverse motion of a spinning circular plate having viscous shear on its surfaces. These equations include rotational inertia and the second order effect of line element rotation. Two solutions for axisymmetric motion of a disc, whole at its center, spinning in a viscous shear field are obtained. These are for small amplitude vibrations of an unconstrained membrane and for large amplitude plate vibrations. The effect of central clamping on vibration frequencies by writing and solving an equation governing transverse motion of a rectangular membrane strip is illustrated. Corroborating experimental data is also given. Dissert. Abstr.

N69-30598 Northwestern Univ., Evanston, Ill.
FREE VIBRATIONS OF ROTATING SHALLOW SPHERICAL SHELLS
Alvin William Filstrup, III (Ph.D. Thesis) 1968 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-1830

The natural vibrations of an elastic, closed, clamped shallow spherical shell segment rotating about its axis of symmetry is determined using classical linear shallow shell bending theory. First the analytical solution of a rotating, nonvibrating shell is obtained and evaluated to determine the equilibrium position about which the vibrations occur. Also, the maximum rotational speed, for which the linear elastic theory holds, is determined. Next the analytical solution of the natural vibrations of a nonrotating shell are reevaluated with greater accuracy than previously obtained in order to determine more precisely the effects, which are small for some modes of rotation upon the natural vibration. Finally, the effects of rotation on the natural vibrations of a clamped shell are determined. Dissert. Abstr.

N69-30606 Carnegie-Mellon Univ., Pittsburgh, Pa.
EXPERIMENTAL INVESTIGATION OF WORK-HARDENING EFFECTS IN WEDGE FLATTENING WITH RELATION TO RIGID/PERFECTLY-PLASTIC THEORY
Marshall L. Devenpeck (Ph.D. Thesis) 1968 113 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-17815

To understand the effect of work-hardening in large plastic flow and how it relates to nonhardening theory, an experimental program of wedge flattening has been performed. Wedges of 20,

30, 45, and 60 degree semiangles were prepared from copper with five levels of prestrain and from two aluminum alloys. Testing was undertaken with care to insure meaningful quantitative data and to permit geometric similarity to occur. The predictions of a nonhardening slip-line solution containing velocity discontinuities were verified by extrapolating the experimentally obtained results to zero work-hardening. This suggests that work-hardening solutions may contain velocity discontinuities for the limiting case of zero work-hardening. Dissert. Abstr.

N69-30635 Institute of Paper Chemistry, Appleton, Wis.
AN EXPERIMENTAL INVESTIGATION OF THE IN-PLANE ELASTIC MODULI OF PAPER
Alan Richard Jones (Ph.D. Thesis) 1967 142 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-18129

It was the hypothesis that paper may be described by the orthotropic model when force is applied parallel to the plane of the sheet. Measurements of Young's modulus, the shear modulus, and Poisson's ratio were made at several directions on six different paper samples. These results were compared to the behavior predicted by the orthotropic model and by Campbell's proposal. Young's modulus was calculated from the initial slope of the load-elongation curve obtained with a table model Instron. Poisson's ratio was measured by taking photographs at three different stress levels of a tensile specimen on which an array of small glass beads were glued. The strains required to calculate Poisson's ratio were obtained from measurements of the bead spacings on the three photographs. To determine the shear modulus, paper cylinders were formed from sheets of the material to be tested. Dissert. Abstr.

N69-30699 Northwestern Univ., Evanston, Ill.
THE DISLOCATION ANALYSIS OF STRESS WITH APPLICATIONS
James David Buch (Ph.D. Thesis) 1968 309 p
Avail: Univ. Microfilms: HC $13.95/Microfilm $4.00 Order No. 69-1807

It is shown that in an anisotropic continuum the dislocation density tensor can be divided into a stress producing part, and a part which produces no stress. The stress producing part can be determined from the stress field. The most general form for the zero-stress field dislocations is given. These results have many immediate applications. From the most general form of zero-stress dislocations, it follows that there are an infinite variety of such dislocation distributions and, since these are zero-strain energy distributions, any future theory of mechanical behavior based upon minimum energy considerations should take these into account. It is shown that the additional requirement of zero-force, zero-stress dislocations still allows an infinite variety of solutions. The stress producing dislocations can also be used as an aid in determining the stress field of known dislocation configurations. Disser. Abstr.

N69-30723# Boelkow G.m.b.H., Ottobrunn Bei Muenchen (West Germany).
THE APPLICATION OF FIBERGLASS REINFORCED RESINS FOR THE MAIN STRUCTURE OF LIGHT AIRPLANES (DEVELOPMENT OF THE LFU 205 AIRPLANE) [ANWENDUNG VON GFK FUER TRAGENDE BAUTEILE IM LEICHTFLUGZEUGBAU (ENTWICKLUNG DES VOLLKUNSTSTOFF-REISEFLUGZEUGES LFU 205)]
F. Och Mar. 1969 36 p refs In GERMAN; ENGLISH summary
Presented at the DGLR Symp., New Mater. and Construction Techniques for Airplanes, Kosln, West Germany, 27 Mar. 1969
(DGLR-69-010) Avail: CFSTI

The criteria leading to the development of the closed hose construction method used in the all-plastic passenger aircraft LFU 205 are set forth and compared with such requirements of modern aircraft design as clean aerodynamics, structural strength, imperviousness to the environment, low weight, and reasonable costs. An account is given of the preliminary tests of this construction technique. The theoretical and experimental optimization approach which formed the basis for the construction of this aircraft is evaluated for applicability to future aircraft construction. The manufacturing and strength problems encountered during the development phase are described, with emphasis on load attachment points in glass-fiber-reinforced plastic structures. The results of static and dynamic strength tests as well as the results of flight tests are also presented. Author

N69-30731 Northwestern Univ., Evanston, Ill.
DYNAMIC STABILITY OF ELASTIC STRUCTURES SUBJECTED TO PERIODIC IMPULSIVE LOADING
Dusan Krajcinovic (Ph.D. Thesis) 1968 116 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-1872

The dissertation examines analytically the phenomenon of the parametric resonance of elastic structures subjected to periodic impulsive load. The problem is treated in linearized form assuming small deformations and uncoupled transverse and longitudinal vibrations. It is thus reduced to the determination of periodic solutions of the governing differential equation. These periodic solutions represent the boundaries separating instability (resonance) from stability regions. The problem is first solved exactly using Floquet's procedure and the stability condition is established. In addition some important properties of the governing differential operator are also discussed. Since the exact treatment has only limited applicability, the problem is also solved using Fourier series expansions. In this way the cases of two and more coupled equations may be solved. Dissert. Abstr.

N69-30737 California Inst. of Tech., Pasadena.
ON THE DYNAMIC BEHAVIOR OF THIN ELASTIC PLATES
Michael John O'Sullivan (Ph.D. Thesis) 1968 125 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-528

Two wave propagation problems are considered: the propagation of acoustic waves in a fluid slab, and the propagation of elastic waves in an elastic slab. When formulated in terms of nondimensional variables these problems depend explicitly on two small parameters ϵ and δ. The parameter ϵ provides a measure of the thinness of the slabs considered and the parameter δ measures the impulsiveness of the applied excitation or loading. Approximate solutions of the problems considered are obtained consisting of several parts, each part having the form of a power series expansion in the parameters ϵ and δ. The most important result obtained is the development of the approximate theories, the plate wave equation and the Euler--Bernoulli plate equation, directly from the full equations of dynamic elasticity using a rational perturbation expansion technique. Dissert. Abstr.

N69-30739 California Inst. of Tech., Pasadena.
STABLE CRACK PROPAGATION IN A VISCOELASTIC STRIP
Hans-Karl Christian Alfred Mueller (Ph.D. Thesis) 1968 144 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-527

A crack of length 2a which propagates with small, constant speed through a viscoelastic strip of width 2b is considered. The strip is strained by displacing its shearfree edges. Linear theory is applied. The stress on the line of crack advancement and the shape of the crack surface are calculated for a state of plane stress. The stress intensity factor which is independent of material properties

is given as a function of a/b. It exhibits a maximum at a/b ≅ 0.75. For a/b > 1.5 the stress intensity factor becomes essentially independent of crack length. The crack surface deflection is obtained in the form of a superposition integral and is a function of material properties and crack speed. The relevant material properties are discussed and presented for a polyurethane rubber. The lower bound of the surface energy is determined from fracture tests on the swollen material. The results of the material characterization are used to calculate the crack speed as a function of applied strain and temperature. Dissert. Abstr.

N69-30754*# National Aeronautics and Space Administration, Washington, D.C.
THE DESIGN OF CONICAL SHELLS SUBJECTED TO ANTISYMMETRIC LOADINGS
A. D. Kovalenko et al Jun. 1969 100 p refs Transl. into ENGLISH of the book "Raschet Konicheskikh Obolochek pri Antisimmetrichnykh Nagruzkakh" Kiev, Naukova Dumka Press, 1966 p 1–494
(NASA-TT-F-518) Avail: CFSTI CSCL 20K

This book presents a method of design of antisymmetrically stressed conical shells, and also of elastic systems consisting of rings, circular plates, cylindrical and conical shells used as construction elements in turboengineering and other branches of mechanical engineering. Formulas and tables for the design of these elastic elements are given. The tables were compiled on the basis of analytical solutions derived on the BESM-2M digital computer. The book is intended for engineers and technicians, as well as research scientists working with the design and strength calculations of thin-walled elements of machines. Author

N69-30763# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
FINITE ELEMENT STRESS ANALYSIS OF PLANE AND AXISYMMETRIC STRUCTURES
J. S. Campbell Jan. 1969 24 p refs
(RD/B/N-1209) Avail: AEC Depository Libraries

Detailed finite element methods are described which are applicable to the stress analysis of plane and axisymmetric structures. The four conditions considered are plane stress, mathematical plane strain (axial strain zero), engineering plane strain (axial strain constant but not zero), and axisymmetric stress. The computer programs FEP and FEX are based on the theory described. Author (NSA)

N69-30815*# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
AN APPROXIMATE THREE-DIMENSIONAL THEORY OF PLATES WITH APPLICATION TO CRACK PROBLEMS
R. J. Hartranft and G. C. Sih May 1969 33 p refs
(Grant NGR-39-007-025)
(NASA-CR-103211; TR-7) Avail: CFSTI CSCL 20K

Using a variational principle, a system of equations is derived for the theory of extension and bending of elastic plates. The equations take into account the stress variations across the thickness of the plate which depend on the characteristic dimensions arising in a given boundary-value problem such as the cavity size, plate thickness, etc. For illustration purposes, the problem of the uniform extension of an infinite plate containing a rectangular crack through the thickness is solved by application of integral representations. Numerical results are displayed graphically and important differences are noted between the solution of the present theory and that obtained by means of the customary equations of generalized plane stress. One of the significant and new features of the solution is that the stress state depends on the plate thickness to crack length ratio and a dimensionless parameter characterizing the stress distribution across the thickness. Author

N69-30943*# Stanford Research Inst., Menlo Park, Calif.
STUDY OF STRAIN-HARDENING NEAR CRACK TIPS
Bill R. Baker and Yapa D. S. Rajapakse [1968] 53 p refs
(Contract NAS1-8032)
(NASA-CR-66798) Avail: CFSTI CSCL 20K

A nonlinear integral equation approach is developed for the elastic–plastic analysis of stresses and strains near crack tips. This approach is considered potentially useful for numerical methods of calculation. If the elastic solution is known, the finite difference network does not have to encompass the complete body, but only needs to include the plastic zone to obtain the plastic part of the solution. Attempts to use this technique to generate simplified models of the material behavior at the crack tip and thereby develop simplified failure criteria were not successful. This work revealed the importance of the description of the microstructure in the region where the crack propagates. It is concluded that this description is as essential as the strain-hardening continuum representation of the material for the establishment of a useful failure criterion. Author

N69-30960# Lehigh Univ., Bethlehem, Pa.
STATIC, FREE VIBRATION, AND STABILITY ANALYSIS OF THIN, ELASTIC SHELLS OF REVOLUTION Technical Report, Apr. 1968–Jul. 1968
Arturs Kalnins Oct. 1968 508 p refs
(Contract AF 33(615)-3870)
(AD-686446; AFFDL-TR-68-144) Avail: CFSTI CSCL 20/11

This project was undertaken to present workable methods of analyses for thin, elastic shells of revolution, and to provide computer programs for performing such analyses. By means of these methods, the following problems for a thin, elastic shell of revolution can be solved: (1) stresses and deflections can be determined when the shell is subjected to arbitrary mechanical and/or thermal loads; (2) natural frequencies and mode shapes can be found for free vibration when the shell is subjected to or is free of prestress; (3) buckling loads, according to the classical stability theory, can be found when the shell is subjected to axisymmetric or sinusoidal nonsymmetric prestress. Author (TAB)

N69-30988# College of Aeronautics, Cranfield (England).
OPTIMUM DESIGN OF FIBRE REINFORCED CORRUGATED COMPRESSION PANELS
D. M. Richards Jan. 1969 14 p refs
(CoA-Aero-209) Avail: CFSTI

Monofilament composite materials offer the possibility of significant structure weight savings, especially for applications where stiffness is important. The optimum design of wide corrugated compression panels is considered, fabricated from laminated monofilament sheet. Local and flexural buckling modes are accounted for, and the analysis is extended to include an over riding maximum stress limitation. Expressions are obtained for optimum corrugation and lamination geometry, and the results are summarized in terms of equivalent surface weight. Author

N69-31058*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
A SEMIEMPIRICAL FRACTURE ANALYSIS FOR SMALL SURFACE CRACKS
Thomas W. Orange Washington Jul. 1969 34 p refs
(NASA-TN-D-5340) Avail: CFSTI

A semiempirical modification of Irwin's fracture analysis for a semielliptical surface crack in a plate is proposed. When it is applied to surface crack test data from the literature, a single toughness parameter is obtained which relates fracture stress to

crack size with reasonable accuracy. The method appears usable when crack size and material thickness are too small to allow a valid analysis using conventional fracture mechanics principles. It is even effective when fracture stresses are above yield. A similar analysis for through-the-thickness cracks is discussed but not evaluated. Application to low-cycle fatigue crack propagation studies is proposed. Author

N69-31061# State Univ. of New York at Buffalo. Div. of Interdisciplinary Studies and Research.

LONGITUDINAL WAVES IN NONLINEAR VISCOELASTIC RODS UNDER INITIAL AXIAL STRESS Summary Report

Francis A. Cozzarelli and Sam Tang Feb. 1969 71 p refs

(Contract Nonr-4449(00))

(AD-686162; Rept-25) Avail: CFSTI CSCL 20/11

Longitudinal wave propagation in a semi-infinite rod is considered, where the medium is nonlinear viscoelastic and under constant initial axial stress, i.e., the rod is undergoing axial creep deformation. The deformation gradient is assumed to be infinitesimal, but the deformation itself may be finite. The constitutive law is taken with stress power functions in the elastic, transient creep and steady creep terms. A wave is generated by a step input in velocity or stress at one end of the rod. It is assumed that the initial stress is much greater then the increment of stress generated by the impact and a perturbation technique is employed. Closed form perturbation stress solutions are obtained for five nonlinear viscoelastic models. Numerical examples are given and discussed. Author (TAB)

N69-31089# Stevens Inst. of Tech., Hoboken, N.J. Davidson Lab.

SMOOTH WATER PERFORMANCE OF A SURFACE PIERCING HYDROFOIL BOAT BASED ON ROTATING-ARM TEST RESULTS AND THEORY Final Report

Albert Strumpf, Conrad Sedlak, and Charles Colombo Nov. 1968 109 p refs

(Contract Nonr-263/39))

(AD-684878; Rept-1264) Avail: CFSTI CSCL 13/10

Results of six-component, rotating-arm test measurements of force and moment on each foil of a 1/15-scale surface-piercing hydrofoil boat model are used as a basis for analyzing its smooth-water motions. Equations of motion are formulated and computer solutions obtained for the steady straight and turning flight characteristics, dynamic stability indices, and trajectory in entering a steady turn under unventilated flow conditions. Most of the required hydrodynamic coefficients are derived directly or indirectly from the test data. The experimental results show strong hydrodynamic bow-to-stern foil interactions which cause either stern foil ventilation near zero sideslip angle or a large reduction in stern foil vertical force. Linearized steady turning theory predicts a turning radius 14 percent smaller than that given by the non-linear motion equations for a rudder angle of 25 deg. Previous experience with surface ships and submersibles also shows that the neglect of non-linear effects causes steady-turning capabilities to be overestimated. Author (TAB)

N69-31132# Boeing Co., Seattle, Wash. Office of International Operations.

A COMPUTATION METHOD OF STRUCTURES IN PLASTICITY AND IN ISOTHERMAL CREEP

R. Valid Apr. 1969 18 p refs Transl. into ENGLISH from French report No. ONERA-TP-667

(F-262; ONERA-TP-667) Avail: CFSTI

A computation method is proposed, for thin structures, of shell or beam type, which can be generalized to their couplings. The method concerns the calculation with large deformations and large displacements. Owing to the nonlinear character of the equations, due to physical and geometrical aspects, a systematic linearization is used. After the description of the constitutive equations used in plasticity and isothermal creep, some results on the control of these laws are mentioned. Author

N69-31183# Boeing Co., Seattle, Wash. Office of International Operations.

DYNAMIC STABILITY BEHAVIOR OF A CYLINDRICAL SHELL UNDER AXIAL IMPACT

G. Fischer Apr. 1969 39 p refs Transl. into ENGLISH from German Report DVL-853 Presented at Joint Yearly Meeting of WGLR and DGRR, Karlsruhe, West Ger., 3–6 Oct. 1967

(F-265; D-82; DVL-853) Avail: CFSTI

An analysis is developed which permits a study of the dynamic stability behavior of thin-walled shells subjected to axial impact. The governing nonlinear initial boundary value problem of elastokinetics is solved by a step-by-step integration. The single steps in chronological order are: (1) determination of the static rotationally symmetric deformation before impact; (2) determination of the dynamic rotationally symmetric deformation caused by impact; (3) determination of instability (critical load, eigenform) of the dynamic rotationally symmetric deformation; and (4) determination of the dynamic non-rotationally-symmetric deformation using the initial conditions (2) and (3). It is shown that dynamic instability of an ideal cylindrical shell can occur under an impact load much lower than the static critical load. Author

N69-31191*# Oklahoma State Univ., Stillwater. School of Mechanical and Aerospace Engineering.

RESEARCH ON CRITICAL STRUCTURAL RESPONSE TO THE SONIC BOOM Final Report

R. L. Lowery Dec. 1968 130 p refs

(Grant NGR-37-002-051)

(NASA-CR-66750) Avail: CFSTI CSCL 20K

This report documents the results of a study of the structural damage potential of the sonic boom. Response prediction for a specific window is complicated by the mechanical and acoustical coupling existing between the window and the remainder of the structure in which it is mounted. A lumped parameter system was derived and used to determine the characteristics for the hypothetical most critical structure. Critical structural configurations for sonic boom response were isolated by first studying the general transient response spectra of undamped systems and then finding the structure that most closely fits the equation. A system having two degrees of freedom was considered the critical case. Comparison of a limited amount of field data with theoretical values was inconclusive. Author

N69-31208# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.

STUDY OF SHOCK IMPEDANCE EFFECTS IN A ROUGH WALLED TUNNEL

Francis B. Porzel Mar. 1969 125 p refs

(Contract DAHC15-67-C-0011)

(AD-684790; RP-P330) Avail: CFSTI CSCL 13/13

The paper deals with the problem of protecting deep underground installations from damage when surface nuclear explosions occur near their tunnel entries. The physical phenomena that occur when an air of long duration (i.e., one caused by a nuclear explosion) passes over the entrance to a tunnel are analyzed. The initial pressure of the shock wave which is subsequently driven down the tunnel is determined, and five sequentially related impedance mechanisms are postulated as controlling the propagation down a roughwalled tunnel. These are entry diffraction, buildup, turbulent choke, wall roughness and feedback. Laboratory and limited

field tests confirm the theory for all five impedance mechanisms. But definite experiments at 1000 + psi or at the level of nuclear explosions have not been performed. Suggestions are made for determining the site and design of tunnels and for the control and decoupling of underground explosions. Author (TAB)

N69-31233# Mound Lab., Miamisburg, Ohio.
FINES ANALYSIS OF PLUTONIUM DIOXIDE MICROSPHERES AFTER IMPACT
P. H. Bonnell 18 Apr. 1969 27 p refs
(Contract AT(33-1)-Gen-53)
(MLM-1626) Avail: CFSTI

Seven capsules containing sized $^{238}PuO_2$ microspheres were impacted into concrete, granite, and sand targets at velocities from 102 to 456 ft/sec (31 to 139 m/sec). The damage to the microspheres and percentage of fines produced were determined. The percentage of fines (particles 0 to 44 μm in diameter) increased with increasing velocity to a maximum percentage between 50 to 55%. Author (NSA)

N69-31265# Gulf General Atomic, San Diego, Calif.
COMPUTATIONAL METHODS IN SOLID MECHANICS AND STRESS ANALYSIS
Y. R. Rashid 1968 27 p refs
(Contract W-7405-eng-26)
(GA-8298) Avail: CFSTI

Progress made in various areas using the finite element method is summarized. The finite element method for problem solution in initial boundary value problems; analysis of two- and three-dimensional solids, plates and shells, and heat conduction and diffusion; inelastic analysis of prestressed concrete pressure vessels; and the dynamic analysis of lumped parameters and systems is discussed. NSA

N69-31300*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TENSILE AND CYCLIC FATIGUE PROPERTIES OF GRAPHITE FILAMENT-WOUND PRESSURE VESSELS AT AMBIENT AND CRYOGENIC TEMPERATURES
Morgan P. Hanson Washington Jul. 1969 13 p refs
(NASA-TN-D-5354) Avail: CFSTI CSCL 20K

Graphite fibers were fabricated into NOL rings and biaxial-wound cylinders. Filament tensile strengths of NOL rings were determined at 75°, −320°, and −423° F (297°, 77° and 20°K). Comparisons were made of ambient-temperature fiber tensile strengths as obtained from NOL rings, strand tests, and biaxially wound cylinders. Fatigue characteristics of internally pressurized cylinders were determined at 75° and −320°F (297 and 77 K). Fatigue comparisons are made of graphite and glass-filament wound cylinders on the basis of specific strength. Author

N69-31390*# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
STRESS INTENSITY FACTOR AND CRACK OPENING FOR A LINEARLY VISCOELASTIC STRIP WITH A SLOWLY PROPAGATING CENTRAL CRACK
H. K. Mueller Jun. 1969 31 p refs
(Grant NGL-05-002-005)
(NASA-CR-103317; GALCIT-SM-69-5) Avail: CFSTI CSCL 20K

The stress intensity factor and crack opening have been calculated for a linearly viscoelastic strip with a slowly propagating central crack. The edges of the infinitely long strip are displaced normal to the crack and the cases of clamped and shearfree strip edges have been investigated. The results are based on the solution to the problem of a suddenly loaded strip with a stationary crack. The resulting integral equation has been solved numerically for arbitrary crack length and analytical solutions in form of asymptotic series are given for crack length up to about half the strip width. The response to a propagating crack is found by superposition. Author

N69-31391*# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
THE FRACTURE ENERGY AND SOME MECHANICAL PROPERTIES OF A POLYURETHANE ELASTOMER
H. K. Mueller and W. G. Knauss Jun. 1969 34 p refs
(Grant NGL-05-002-005; Contract F04611-67-C-0057)
(NASA-CR-103313; GALCIT-SM-69-4) Avail: CFSTI CSCL 20K

The energy which is required to form a unit of new surface in the fracture of a polyurethane elastomer is determined. The rate sensitivity of the material has been reduced by swelling it in toluene. This paper describes primarily the experimental work of measuring the lower limit of the fracture energy. Starting with this value and the creep compliance the rate dependence of the fracture energy for the unswollen material has been determined. It is thus shown that the dependence of the fracture energy on the rate of crack propagation is caused by the energy dissipation around the tip of the crack. Good agreement between the theoretically and experimentally determined relationship for the rate sensitive fracture energy is demonstrated. Author

N69-31398# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE MEASUREMENT OF TRANSIENT DISPLACEMENTS ALONG THE SIDE OF A METALLIC CYLINDRICAL ROD DURING THE PASSAGE OF A PLASTIC WAVE
John H. Suckling and John T. Frasier Feb. 1969 18 p refs
Presented at the Army Symp. on Solid Mech., 1968
(AD-686290; MR-1984) Avail: CFSTI CSCL 13/13

The radial displacement provided by a constant velocity impact applied to one end of a cylindrical rod is studied by means of a streak interferometric technique. The resulting continuous spatial and temporal display of data has distinct advantages over that of other transducers which give their output parameters as a function of time at discrete points on the specimen. The sensitivity and detail of data collected with this technique over an extended portion of the specimen are considered necessary for the study of the constitutive relationships of solids at or near their yield point. Representative interferograms are shown and displacement data are reduced from them for direct comparison with predictions based on static stress-strain curves. A method is outlined which shows how the interferometric results might be used to establish the constitutive relationship of the material with minimal initial assumptions. Author (TAB)

N69-31486# California Univ., Berkeley. Div. of Applied Mechanics.
ON LINEAR VISCOELASTIC RODS
W. J. Shack Jan. 1969 43 p refs
(Contract N00014-67-A-0114)
(AD-686390; AM-69-5) Avail: CFSTI CSCL 20/11

The paper is based on the general thermodynamical theory of a Cosserat continuum developed by Green and Laws. Specific constitutive equations are given for a linear viscoelastic material. When the form of the free energy is restricted by certain symmetry conditions, the basic equations separate into four groups, two for flexure, one for torsion, and one for extension of the rod. Thermal effects occur only in the last group. Flexural and torsional wave propagation along an infinite rod are considered. Author (TAB)

N69-31490*# Solar, San Diego, Calif. Propulsion and Vehicle Engineering Lab.
APPLICATION OF INTEGRAL DAMPING FOR DUCT ASSEMBLY VIBRATION SUPPRESSION Final Report
G. E. Bowie and W. A. Compton Apr. 1969 131 p refs
(Contract NAS8-21126)
(NASA-CR-102206; RDR-1554-6) Avail: CFSTI CSCL 20K

The objective of this study was to compare the fundamental bending mode vibratory response of simply supported uniform ducts with the response of ducts modified by the addition of midspan damping sleeves. An experimental approach was followed which included the measurement of midspan response of uniform ducts, development of metallurgical bonding procedures for attaching damping sleeves to ducts, and determination of response and fatigue lives of damped ducts. The scope of the program encompassed experiments on uniform ducts made of four structural alloys and of three geometries, and on ducts of three materials and three geometries modified by the addition of uniform midspan damping sleeves made of one high damping structural alloy. Author

N69-31510*# Techtran Corp., Glen Burnie, Md.
STUDY OF SMALL HARMONIC VIBRATIONS OF A HEATED STRUCTURE IN THE VICINITY OF A LOADING STATE CORRESPONDING TO A PARTIAL ENTRY INTO THE PLASTIC DOMAIN [ETUDE DES PETITES VIBRATIONS HARMONIQUES D'UNE STRUCTURE CHAUFEE AUTOUR D'UN ETAT DE CHARGEMENT CORRESPONDANT A UNE ENTREE PARTIELLE DANS LE DOMAINE PLASTIQUE]
Henri Loiseau Washington NASA Jul. 1969 19 p refs Transl. into ENGLISH from Conf. Paper ONERA-TP-604 Presented at the 6th Intern. Congr. of Aeron. Sci., Munich, 9–13 Sep. 1968
(Contract NASw-1695)
(NASA-TT-F-12320) Avail: CFSTI CSCL 20K

An experimental apparatus was created to determine the dynamic characteristics of an aircraft or missile subjected to heavy loads and to a large heat flux. In particular, it permits following of the evolution of the vibration eigenvalues in a continuous manner during the phase of kinetic heating, simulated for instance, due to a heating apparatus using infrared tubes. This apparatus was successfully used for studying small vibrations of materials in the plastic domain, or of models or full size structures. Author

N69-31528# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
TRANSIENT RESPONSE OF A RING-STIFFENED SPHERICAL SHELL IMMERSED IN AN ACOUSTIC MEDIUM
Yung Kia Lou and Jerome M. Klosner Apr. 1969 65 p refs
(Contract Nonr-839(40))
(AD-686157; PIBAL-69-12) Avail: CFSTI CSCL 20/11

The transient response of a ring-stiffened spherical shell to a sudden pressure increase in the surrounding acoustic medium is investigated. A modal expansion approach is used to analyze the shell, while the acoustic field equation is solved by invoking the Helmholtz integral. Coupling of the two fields occurs through the enforcement of continuity of the velocity components at the shell-fluid interface. Two solutions to the same problem are obtained by using plane and cylindrical wave approximations of the acoustic field. These approximate solutions fail to predict the transient behavior for the shell configuration analyzed. The result of this study indicates that a large dynamic factor must be assumed in the design of submerged stiffened spherical shell structures, if explosive loads are likely to be encountered. Author (TAB)

N69-31568# Technischer Verberwachungs-Verein Rheinland, E. V. Cologne (West Germany). Institut fuer Reaktorsicherheit.
FAILURE RATES OF PRESSURE VESSELS. PART 1: EVALUATION OF VdTUEV STATISTICS
G. Siopianka and G. Mieze [1968] 43 p refs
(IRS-I-34(1968)) Avail: AEC Depository Libraries

To obtain some indication of the failure behavior of nuclear pressure vessels, the information compiled by the Technischen Uberwachungs–Vereine (TUV) since 1952 on the failure of non-nuclear pressure vessels and boilers was evaluated statistically. The results of the evaluation are presented, and their possible application to reactor pressure vessels is discussed. NSA

N69-31621*# General Electric Co., Daytona Beach, Fla. Apollo Systems Dept.
STUDY OF TECHNOLOGY REQUIREMENTS FOR STRUCTURES OF LARGE LAUNCH VEHICLES. VOLUME 1: SUMMARY Final Report
1 Jul. 1969 41 p refs
(Contract NAS2-5047)
(NASA-CR-73343) Avail: CFSTI CSCL 20K

Of the advanced structural constructions studied, aluminum honeycomb offers reduction in both cost and structural weight. Advanced filamentary composites, such as carbon/epoxy or boron/epoxy honeycomb, used judiciously, reduce the weight of compressively loaded structures by as much as 80 percent with only a slight increase in cost. Economic benefits from the payload gain permitted by this structural weight reduction should be significant. Further studies are recommended of a future launch vehicle of simplified design and ruggedness achieved through elevated safety factors coupled with advanced materials. Aluminum honeycomb (or fiber-glass epoxy honeycomb) appears attractive for the initial design. Considerable future potential for this design concept may be achieved through substitution of advanced composites, such as carbon/epoxy or boron/epoxy honeycomb, as these materials are more thoroughly developed and become available. Author

N69-31622*# General Electric Co., Daytona Beach, Fla. Apollo Systems Dept.
STUDY OF TECHNOLOGY REQUIREMENTS FOR STRUCTURES OF LARGE LAUNCH VEHICLES. VOLUME 2: ANALYSIS OF TECHNICAL AND ECONOMIC IMPACT Final Report
1 Jul. 1969 175 p refs
(Contract NAS2-5047)
(NASA-CR-73344) Avail: CFSTI CSCL 20K

Of the advanced structural constructions studied, aluminum honeycomb offers both a cost reduction (15 percent) and a structural weight reduction (45 percent) compared with present technology. Present technology in this study is represented by aluminum integrally stiffened skin construction. Use of advanced filamentary composite materials, such as carbon/epoxy honeycomb, results in reductions in structural component weight of up to 80 percent of that from present technologies, and with only a slight increase in cost. Trade-off studies of increased vehicle costs against the payload value gained with this reduced weight show that significant economic benefits can result from the use of advanced materials. In addition, reductions in cost are achieved for some materials through increased structural safety factor and the accompanying overdesign or design simplification. Aluminum honeycomb, for example, shows a 28% cost reduction when the safety factor is doubled. Author

N69-31623*# General Electric Co., Daytona Beach, Fla. Apollo Systems Dept.
STUDY OF TECHNOLOGY REQUIREMENTS FOR STRUCTURES OF LARGE LAUNCH VEHICLES. VOLUME 3: SURVEY OF ADVANCED STRUCTURES TECHNOLOGIES Final Report

1 Jul. 1969 169 p refs
(Contract NAS2-5047)
(NASA-CR-73345) Avail: CFSTI CSCL 20K

Over 100 references have been reviewed and digested, and nearly as many contacts with industry and government agencies were reviewed to insure that the data in this report provide the latest information on today's structural technologies. Hence, this report provides a unique compilation of today's status of large launch vehicle advanced materials and structural configurations; nevertheless, it is emphasized that limitations of time and expense have necessarily precluded the possibility of providing complete coverage of the subject and there are undoubtedly many other applicable documents which have not been included or reviewed. A potentially attractive method of combining metal technology with composite technology through the use of unidirectional composite stiffeners with metallic shell structure is discussed briefly. Structural reliability, test and inspection technologies are considered.
Author

N69-31634# Lockheed Missiles and Space Co., Palo Alto, Calif.
CHAPTER 6. THEORY OF ELASTOPLASTIC DEFORMATIONS. CHAPTER 7. FLOW THEORY
N. N. Malinin [1968] 38 p refs Transl. into ENGLISH from the book "Prikladnaia Teoriia Plastichnosti i Polzuchesti" Moscow, Mashgiz., 1968 p 132–171
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The theories of elastoplastic deformations and flow are considered. The underlying hypotheses of the theory of deformation are: (1) The volume deformation is directly proportional to the mean normal stress, where the proportionality coefficient connecting them is the same as within the elastic limits. (2) The components of the strain deviator are proportional to the stress deviator components. (3) The stress intensity is a function of the strain intensity, which is independent of the kind or state of stress. Formulations for each hypothesis are developed, and experimentally verified. It is concluded that unloading stresses and strains are determined by solving the elastic theory problems for external forces equal to the differences between the loading forces and the residual forces after unloading. The fundamental hypotheses of the flow theory are enumerated, and formulas obtained, establishing a stress–strain dependence for both step and linear loadings.
F.O.S.

N69-31656# Lockheed Missiles and Space Co., Palo Alto, Calif.
WAVE PROCESSES IN AN ELASTIC THIN-WALLED CYLINDRICAL SHELL UNDER SUDDEN APPLICATION OF A FORCE TO ITS ENDFACE
A. I. Malyshev 27 May 1968 5 p refs Transl. into ENGLISH from Tr. Vses S'Ezoa Teor. Prikl. Mekh., 2nd (Moscow), no. 2, 1969 p 138–141
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The propagation of stress waves and displacements in a thin-walled cylindrical shell, which result from the application of an axisymmetric compressive force to its endface, is investigated. The forces change in time according to a law described by the Heaviside function. The membrane shell theory is utilized. An analogous problem is solved for a semi-infinite shell on whose endface is applied a step varying velocity. The results have been obtained by numerical methods utilizing a computer, and the asymptotic solution obtained is valid only for large times. Closed solutions are obtained for both a semi-infinite shell, and for a finite shell where these solutions are valid for any time. For the times close to the time of force application, the formulas acquire a simple form convenient for engineering computations.
Author

N69-31680# Lehigh Univ., Bethlehem, Pa. Office of Research.
INVESTIGATION OF THE SOLIDIFICATION, STRUCTURE AND PROPERTIES OF EUTECTIC ALLOYS INCLUDING CONSIDERATION OF PROPERTIES CONTROL
R. W. Kraft and R. W. Hertzberg Jun. 1969 10 p refs
(Grant NGR-39-007-007)
(NASA-CR-103310 Avail: CFSTI CSCL 20M

Presented is a summary of the research done on eutectic alloys. The potential of eutectic composites as structural materials at elevated temperatures or under cyclic loading conditions, and the physical and mechanical properties of the alloys are discussed. Also discussed is the solidification process in vertical direction ingots of some of the eutetic alloys.
E.H.W.

N69-31705# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AXISYMMETRIC VIBRATIONS OF A CYLINDRICAL SHELL IN A MAGNETIC FIELD
G. E. Bagdasaryan et al 24 Jan. 1969 11 p refs Transl. into ENGLISH from Iz. Akad. Nauk Arm., SSR, Mekhan. (Yerevan), v. 20, no. 5, 1967 p 21–27
(AD-686379; FTD-HT-23-1084-68) Avail: CFSTI CSCL 20/11

The axisymmetric vibrations of an elastic cylindrical shell of infinite length are studied. The shell is made of a material which has a finite constant electroconductivity in the presence of a longitudinal magnetic field. The induced electromagnetic field and the vibration frequency of the shell as a function of field intensity and material conductivity are determined by a simultaneous solution of Maxwells equations and the equations of motion of the shell.
Author (TAB)

N69-31711# Oak Ridge National Lab., Tenn.
EXPERIMENTAL AND ANALYTICAL INVESTIGATIONS OF THE STRUCTURAL BEHAVIOR OF NOZZLE-TO-SHELL ATTACHMENTS
W. L. Greenstreet and R. C. Gwaltney Apr. 1969 51 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2526) Avail: CFSTI

Experimental and analytical investigations of nozzle-to-shell attachments are described. Both elastic and plastic behavior of single nozzle-to-shell attachments were studied, as well as elastic behavior of multiple nozzles in closely spaced clusters. The studies being made and the contributing roles of the organizations engaged in these studies are reported.
Author (NSA)

N69-31767# California Univ., La Jolla. Dept. of Aerospace and Mechanical Engineering Sciences.
A SIMPLIFIED MODEL FOR THERMAL SHOCK AND SPALLATION IN PARTIALLY TRANSPARENT ELASTIC MATERIALS UNDER ENERGETIC RADIATION
W. Nachbar May 1968 38 p refs
(Grant AF-AFOSR-1226-67)
(AD-675645; AFOSR-68-1552; TR-11) Avail: CFSTI CSCL 20/11

In an elastic half space, thermal shock can be induced by radiant energy deposited into the material at some depth below the surface. The present paper considers plane wave motion set up by such a shock which is assumed to produce instantaneously a constant temperature rise above ambient to a certain depth below the surface and zero temperature rise at greater depths. This assumption of a rectangular pulse in space enables the wave motion to be followed by simple formulas and diagrams. It is demonstrated that the initial compressive stresses produce a tensile pulse of half the initial amplitude, and that the waves proceed without imparting net momentum to the medium. If fracture occurs in tension, part of the material will spall, and a solution is obtained

for the wave motion following the first spallation. It is shown that a second and multiple spalls can arise if there is a delay time associated with fracture which is of the right order of magnitude. The delay time acts to decrease the amount of momentum carried off in the spall and so to retain part of the tensile wave for further spallation. Author (TAB)

N69-31762# Lockheed Missiles and Space Co., Palo Alto, Calif.
CYLINDRICAL SHELL SUBJECTED TO AN AXIAL SHOCK LOADING
I. I. Kiiko [1969] 4 p refs Transl. into ENGLISH from Tr. Vses. S'ezda Teor. Prikl. Mekh., 2nd (Moscow), no. 2, 1969 p 135–138
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Shell deflection modes are investigated as a function of the loading, where the latter is considered greater than the upper critical loading. A solution, suitable for a qualitative estimate of the shell motion in the post-critical stage, is based on a linear theory, and the assumption of the nature of the shell deflections on the flexure of the cylindrical surface. This solution is compared with the results of experiments in which the deflection modes are recorded by a camera. Author

N69-31767# Explosives Research and Development Establishment, Waltham Abbey (England).
MECHANICAL TEST EQUIPMENT TO STUDY FLEXURAL RELAXATION AND RELATED PROPERTIES
B. L. Hammant and J. Roberts 8 Nov. 1968 47 p refs
(AD-686153; ERDE-14/R/68) Avail: CFSTI CSCL 20/11

A new flexural test to study stress relaxation is described and data presented for low density polyethylene, polytetrafluoroethylene (PTFE), polypropylene, mild steel, and carbon fibre composite. It is shown that the test can be used quantitatively or qualitatively to provide data for quality control, engineering design, or polymer research requirements. Author (TAB)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N69-30507*# Scripta Technica, Inc., Washington, D.C.
LIQUID METALS
P. L. Kirillov, ed., et al NASA May 1969 474 p refs Transl. into ENGLISH of the book "Zhidkiye Metally" Moscow, at Atomizdat., 1967 p 1–446
(Contract NASw-1694)
(NASA-TT-F-522) Avail: CFSTI CSCL 20M

Problems pertaining to the development of fast neutron reactors are discussed in terms of heat transfer in round, annular, and square channels; heat transfer and fluid dynamics of intricately-shaped passages; boiling and condensation of metals; and techniques of working with liquid metals. For individual titles, see N69-30508 through N69-30548. M.G.J.

N69-30508*# Scripta Technica, Inc., Washington, D.C.
STUDY OF HEAT TRANSFER IN LIQUID METALS IN ROUND PIPES
V. D. Talanov et al *In its* Liquid Metals May 1969 p 1-7 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 20M

Experimental heat transfer data for mercury and a sodium–potassium alloy in stainless steel and copper tubes are presented. Empirical dimensionless equations proposed by previous investigators were found to correlate well with the experimental data. Thermal contact resistance was shown to be negligible under the experimental conditions, provided that the liquid metal oxides are in the dissolved state. Author

N69-30509*# Scripta Technica, Inc., Washington, D.C.
HEAT TRANSFER WITH LIQUID METAL IN A VERTICAL PIPE AT LOW PECLET NUMBERS
N. A. Ampleyev et al *In its* Liquid Metals May 1969 p 8-27 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 20M

An analysis is presented of theoretical and empirical formulas for calculating heat transfer processes at low Peclet numbers in order to clarify the cause for disagreement among the previous investigators. Differences in previous equations are attributed, in part, to natural convection effects, end heat losses, and entrance conditions. Absence of thermal resistance effects was confirmed, and the effect of 1/D (length of thermal stabilization/initial velocity distribution) studied. Author

N69-30510*# Scripta Technica, Inc., Washington, D.C.
HEAT TRANSFER OF SODIUM AND A SODIUM-POTASSIUM ALLOY IN SHORT VERTICAL PIPES BY COMBINED CONVECTION
L. G. Volchkov et al *In its* Liquid Metals May 1969 p 28-39 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 20M

Under the experimental conditions, the combined convection heat transfer was found to be appreciably higher than in forced convection only. In short ducts, the length had little effect on heat transfer, although the effect remains unclear. The temperature field agreed with theoretical predictions based on the stabilized laminar flow problem. Author

N69-30511*# Scripta Technica, Inc., Washington, D.C.
TAKING INTO ACCOUNT LONGITUDINAL HEAT FLOW WHEN MEASURING THE AVERAGE TEMPERATURE OF FLUIDS IN PIPES AND HEAT EXCHANGES FOR LOW PECLET NUMBERS
M. K. Gorchakov *In its* Liquid Metals May 1969 p 40-52 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 20M

The relationship between actual, average, fluid temperature and its theoretical value in tubes at constant heat fluxes, as well as in double-pipe heat exchangers with identical flow rates in both passages, is analyzed. An evaluation is made of the effects of velocity profile shape, channel geometry, longitudinal heat conduction, and nonuniformity of heat flux. Author

N69-30513*# Scripta Technica, Inc., Washington, D.C.
STATISTICAL CHARACTERISTICS OF TEMPERATURE FLUCTUATIONS IN HEAT EXCHANGER WALLS ATTENDANT TO HIGH THERMAL FLUXES
M. Kh. Ibragimov et al *In its* Liquid Metals May 1969 p 71-81 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 20M

Measurements were made of temperature fluctuations in the wall of a double-pipe heat exchanger, in which the same liquid metal agent was flowing through each duct at different temperatures. Various statistical characteristics, intensities, and cross-correlation functions were then determined. Experimental equipment and data are described and analyzed. Author

N69-30514*# Scripta Technica, Inc., Washington, D.C.
HEAT TRANSFER IN TURBULENT FLOW OF FLUIDS IN SQUARE DUCTS
M. Kh. Ibragimov et al *In its* Liquid Metals May 1969 p 82–99 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 20M

Results of a heat transfer study in a square duct with water and mercury are presented. Temperature fields in the wall and fluid were obtained, as well as the statistical characteristics of turbulent temperature fluctuations. The inapplicability of equations for round pipes to square ducts was demonstrated. The effect of secondary flows on heat transfer was experimentally determined. Correction factors for square ducts are presented. Author

N69-30516*# Scripta Technica, Inc., Washington, D.C.
EFFECT OF ECCENTRICITY ON HEAT TRANSFER TO LIQUID METALS IN ANNULAR SPACES
V. I. Subbotin et al *In its* Liquid Metals May 1969 p 108–119 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 20M

The effect of spacing ribs and eccentricities on the surface temperature field of heat conducting tubes was studied. A sodium–potassium liquid coolant, flowing in a narrow annulus, was used. Close agreement with previous experimental data for eccentric, but ribless, annuli was demonstrated. Author

N69-30517*# Scripta Technica, Inc., Washington, D.C.
TRANSFER OF HEAT IN TURBULENT FLOWS OF FLUIDS IN ANNULAR AND PLANE SPACES
N. I. Buleyev et al *In its* Liquid Metals May 1969 p 120–129 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 20M

Calculations of temperature fields and heat transfer coefficients for turbulent flow in annular and plane spaces are presented. Use in made of integral approximations for turbulent coefficients of thermal conductivity. The calculated heat transfer coefficients for several fluids are compared with the available experimental data. Author

N69-30518*# Scripta Technica, Inc., Washington, D.C.
EXPERIMENTAL STUDY OF HEAT TRANSFER FROM A FLAT HORIZONTAL SURFACE TO SODIUM BY FREE CONVECTION
A. P. Kudryavtsev et al *In its* Liquid Metals May 1969 p130–135 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 20M

Heat transfer levels in liquid metals were compared under boiling and free convection conditions. Experimental data were satisfactorily correlated by previously derived equations. A different set of heat transfer equations applies, however, for turbulent and laminar-free convection regions. Author

N69-30520*# Scripta Technica, Inc., Washington, D.C.
HEAT TRANSFER FROM LOOSELY-SPACED [FUEL] ROD CLUSTERS TO LIQUID METAL FLOWING IN THE AXIAL DIRECTION
A. V. Zhukov et al *In its* Liquid Metals May 1969 p 149–169 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 20M

The present article considers experimental heat transfer data obtained with fuel rod clusters to liquid metal in longitudinal (axial) flow past the rods. It is assumed that temperature variation over rod perimeter is small and that the heat transfer coefficients depend little on rod geometry, jacket thickness, thermal conductivity of the fissionable material and of the jacket. Empirical equations are derived and data are compared with existing correlations. Author

N69-30522*# Scripta Technica, Inc., Washington, D.C.
HEAT TRANSFER IN THE INTERTUBULAR SPACE OF LIQUID-METAL HEAT EXCHANGERS
P. L. Kirillov et al *In its* Liquid Metals May 1969 p 190–199 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 20M

The paper presents the data of an experimental heat transfer study with axial flow of a liquid metal coolant. The correlation for average heat transfer coefficient as a function of coolant velocity and cluster geometry has been obtained. Effect of tube oxidation on heat transfer has been studied and analyzed. Author

N69-30523*# Scripta Technica, Inc., Washington, D.C.
ANALYSIS OF THE APPLICABILITY OF AVERAGE HEAT-TRANSFER COEFFICIENTS IN HEAT-EXCHANGER DESIGN
P. A. Ushakov *In its* Liquid Metals May 1969 p 200–206 (See N69-30507 17-33)
Avail: CFSTI CSCL 20M

This paper compares different available methods of obtaining average heat transfer coefficients for short heat exchangers. It is shown that it is preferable to employ average heat transfer coefficients calculated on the basis of average temperature difference between the wall and the fluid, to the use of integrated values of local heat transfer coefficients. Author

N69-30527*# Scripta Technica, Inc., Washington, D.C.
ELECTRONICALLY-HEATED SETUP FOR THE STUDY OF HEAT TRANSFER FROM BOILING METALS BY FREE CONVECTION
A. A. Ivashkevich et al *In its* Liquid Metals May 1969 p 249–264 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 20M

The authors present a discussion of an experimental study of electronically heated system for pool boiling of liquid metals. Very high heat fluxes which can be easily measured were obtained. Author

N69-30528*# Scripta Technica, Inc., Washington, D.C.
TRANSFER OF HEAT FROM SODIUM BOILING IN A LARGE VESSEL
A. P. Kudryavtsev et al *In its* Liquid Metals May 1969 p 265–280 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 20M

Boiling studies with sodium were carried out at flat horizontal plates heated by electron bombardment. The heaters were made of stainless steel. Comparison of pool boiling data obtained in previous experiments shows generally satisfactory agreement. Effect of dissolved oxygen on heat transfer is considered. Author

N69-30529*# Scripta Technica, Inc., Washington, D.C.
EXPERIMENTAL STUDY OF CRITICAL THERMAL FLUXES IN SODIUM BOILING IN A LARGE VESSEL
A. P. Kudryavtsev et al *In its* Liquid Metals May 1969 p 281–286 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 20M

Data of an experimental burnout study with liquid sodium on flat horizontal surface are presented. The obtained data and data of other researchers are still too scarce, in the opinion of the authors, to allow the derivation of an empirical generalized correlation. Author

N69-30531*# Scripta Technica, Inc., Washington, D.C.
TRANSFER OF HEAT FROM CONDENSING SODIUM VAPOR
N. B. Bakulin et al *In its* Liquid Metals May 1969 p 294–299 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 20M

The paper analyzes the effect of boundary conditions on heat transfer in condensation of pure "stationary" sodium vapor. The temperature field in the vapor in the liquid metal and the wall were measured. The effect of noncondensing gases and other contaminants is considered. Author

N69-30547*# Scripta Technica, Inc., Washington, D.C.
CALCULATIONS OF HEAT TRANSFER IN LIQUID METALS
In its Liquid Metals May 1969 p 437–445 refs (See N69-30507 17-33)
Avail: CFSTI CSCL 20M

Recommendations are presented for calculating heat transfer to liquid metals based on world-wide data published up to January 4, 1966. Equations are given for convective heat transfer in round tubes, rectangular ducts, concentric and eccentric annuli, and rod and tube clusters. Equations for condensation of liquid metal vapor are presented. Combined free and forced convection are given. Author

N69-30726*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DATA-REDUCTION TECHNIQUE FOR DETERMINING RAPIDLY RISING HEATING RATES TO THERMALLY THICK WALLS
James L. Dillon, Robert L. Wright, and G. Louis Smith Washington Jul. 1969 28 p refs
(NASA-TN-D-5309) Avail: CFSTI CSCL 20M

The integral method of determining aerodynamic heat flux from temperatures measured at four locations within a thermally thick wall was analyzed for rapidly rising heating rates and large thermal as well as physical thicknesses. A restricted-exponential function was developed for curve fitting the four values of $c_w(T)\frac{\partial T}{\partial t}$ through the wall (where c_w denotes specific heat of wall material; T, temperature; and t, time). The restricted-exponential function more accurately describes the variation of $c_w(T)\frac{\partial T}{\partial t}$ through the wall than the previously used polynomial curve fit and improves the accuracy of the integral heating method for determining rapidly rising heating rates to walls of large thermal thickness (large temperature gradients through the wall). Results are presented for simulated flight measurements for both smooth temperature data and scattered temperature data (standard deviation of 150° R_n or 8.3°K) for two arrangements of sensor locations through the wall. Author

N69-30742 Pennsylvania Univ., Philadelphia.
AN ANALYSIS OF THE THERMAL CONDUCTIVITY OF CERTAIN GRAPHITE COMPOUNDS WITH A VIEW TO THERMOELECTRIC APPLICATIONS
Sadasivam Sachidanandam (Ph.D. Thesis) 1968 147 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 69-165

The thermal conductivity of a certain class of lamellar compounds of graphite in the c-direction is analyzed as follows. The atomic vibrations of a layer of the solute sandwiched by the carbon layers in the lamellar compound are examined in the long wavelength limit. The acoustic vibrations of the host lattice are assumed to be given by the model of an elastically coupled chain of thin plates. A single defect layer is then shown to be well approximated by the replacement of a plate in the chain by a membrane with a coupling in pure graphite. The parameters characterizing the defect are estimated by assuming reasonable interatomic potentials. The scattering of the acoustic phonons at the defect is estimated in terms of a relation time. The ideal graphite thermal conductivity is analyzed with phenomenological relaxation times for the three phonon processes and the parameters determined by a comparison of the calculation with the reported measurements on near ideal samples. Dissert. Abstr.

N69-30807# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
THERMODYNAMIC DATA FOR FERRIC SULFATE AND INDIUM SULFATE
L. B. Pankratz and W. W. Weller Jul. 1969 9 p refs
(BMRI-7280) Avail: Issuing Activity

Low- and high-temperature thermodynamic properties were determined for anhydrous ferric sulfate and anhydrous indium sulfate. Low-temperature heat capacities were measured between 50° and 298° K, and enthalpy increments above 298° K were determined. The high-temperature measurements of $Fe_2(SO_4)_3$ extended to 900° K and those of $In_2(SO_4)_3$ to about 1,000° K. A minor transition was found for $Fe_2(SO_4)_3$ at 800° K, with a heat of transition of 540 cal/mole. Tabulations were made of the low-temperature heat capacities and the high-temperature enthalpy and entropy increments. The 298°K entropies derived from the low-temperature measurements were 67.6±0.5 cal/deg mole for ferric sulfate and 72.2±0.5 cal/deg mole for indium sulfate. High-temperature enthalpy increments were also given in equation form. Author

N69-30809# Argonne National Lab., Ill.
THERMODYNAMIC STABILITY OF URANIUM-HEXA-FLUORIDE [TERMODINAMICHESKAYA USTOICHIVOST GEKSAFTORIDA URANA]
Yu. N. Tumanov Mar. 1969 12 p refs Transl. into ENGLISH from Zh. Neorg. Khim. (Moscow), no. 13, 1968 p 1488–1493 Sponsored by AEC
(ANL-TRANS-738) Avail: CFSTI

Since UF_6 disintegrates to UF_4 during heating to temperatures of 1400 to 2000°K and pressures of 0.1 to 0.001 atm, the thermodynamic functions of UF_4 can be used to determine the thermodynamic stability of UF_6. An empirical method for the calculation of the thermodynamic functions of gaseous UF_4 is proposed. It is based on the two following assumptions: the total of the oscillation and rotational functions of the tetrafluoride does not depend on the choice of the quantum-mechanical model of the number potentially possible for the given molecule; and the length of the U^{4}–F bond is noticeably smaller (±0.02 Å) than the length of the U^{6}–F bond. Using SF_4 as an example, an evaluation was made of the errors in the thermodynamic calculation of the functions of $(UF_4)_{gas}$ using the model of normal tetrahedron. In the

approximation of the model of the rigid rotator–harmonic oscillator, the values of the standard entropy and reduced thermodynamic potential of the gaseous UF_4 were calculated in the temperature interval from 298.16 to 2000°K. The equilibrium constants of the thermal cracking of $(UF_6)_{gas}$ were calculated and the percent yields of the gaseous tetrafluoride in the equilibrium mixture were evaluated.
Author (NSA)

N69-30871*# Thermo Electron Corp., Waltham, Mass.
HYDROGEN-OXYGEN FIRED THERMIONIC GENERATORS AND THERMIONIC DIODES
3 Apr. 1969 67 p
(Contract NAS9-4282)
(NASA-CR-101745; TE-5045-145-69) Avail: CFSTI CSCL 20M

The hardware described in this paper served to evaluate the state-of-the-art of thermionic flame-heated devices for use in a short (a few hours to a few days) space mission. The reactants available as fuel and oxidant in the mission were expected to be hydrogen and oxygen, and these same reactants were employed in this work. Two hydrogen-oxygen 50 watt generators and two spare thermionic diodes were built. Although the generators were successfully operated, their efficiency was far below that initially expected. Self-bonded silicon carbide was the only material available that could resist the high temperatures and the thermal shock. This material was found highly permeable to hydrogen, and this precluded the design of a truly efficient combustor. Use of vapor-deposited silicon carbide, either free-standing or as a coating, is recommended as a way of circumventing the above difficulty in future devices.
Author

N69-30904# Ballistics Research Labs., Aberdeen Proving Ground, Md.
A UNIFIED ACCOUNT OF TWO-LEVEL METHODS FOR THE ONE-DIMENSIONAL HEAT EQUATION
John H. Giese Jan. 1969 31 p refs
(AD-684903; BRL-MR-1956) Avail: CFSTI CSCL 20/13

The most general three-parameter family of six-point, two-level difference approximations to the one-dimensional heat operator has been derived. A complete stability analysis has been performed. All familiar two-level approximations are included as special cases.
Author (TAB)

N69-30913# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
AERODYNAMICS OF A TURBULENT DIFFUSION FLAME JET IN A WAKE FLOW
Sh. A. Ershin et al 13 Feb. 1969 13 p refs Transl. into ENGLISH from Vestn. Akad. Nauk Kaz. SSR (Alma-Ata), v. 18, no. 4(205), 1962 p 46–51
(Contract NOw-62-0604-c)
(AD-686461; APL-CLB-3-T-579) Avail: CFSTI CSCL 13/8

A study is made of the aerodynamics of a turbulent diffusion flame jet developing in a homogeneous wake flow. A second extremum (minimum) is found in the dynamic head profiles. The nature of the effect of the wake-flow velocity on the structure of the flame is clarified. The experimental results can be explained on the basis of the general theory of free turbulence in an isobaric flow.
Author (TAB)

N69-31094# Electricity Council Research Centre, Capenhurst (England).
THERMAL CONDUCTIVITY OF BARYTES AND CHROME DUST: INFLUENCE OF PARTICLE SIZE
D. J. Dickson Dec. 1968 9 p
(ECRC/N136) Avail: CFSTI

New types of storage heater require moderately effective thermal insulation having a higher heat capacity than conventional insulents. Barytes and chrome dust have been suggested to satisfy this requirement. The influence of particle size on the thermal conductivity and packing density of these materials has been determined.
Author

N69-31167# Harvard Univ., Boston, Mass. Harvard Air Cleaning Lab.
APPLICATION OF A PEBBLE BED HEAT-SINK TO THE FAST FLUX TEST FACILITY CLEANUP SYSTEM
E. Bulba, and D. Underhill Mar. 1969 25 p refs
(Contract AT(30-1)-841)
(NYO-841-17) Avail: CFSTI

Mathematical equations have been developed for computing gas temperatures within a ventilation cleanup system following the accidental release and burning of Na coolant within the containment volume of the Fast Flux Test Facility. The derivation is based on the assumption that the Facility is equipped with a cleanup system consisting of a pebble bed heat-sink and bag filters. The approach is unique in that it permits computation of heat transfer under conditions of a variable inlet gas temperature to the bed. One difficulty in the analysis is that under operating conditions it is anticipated that major amounts of Na fume will deposit within the bed.
Author (NSA)

N69-31186# Oak Ridge National Lab., Tenn.
POOL-BOILING CRITICAL HEAT FLUXES FOR NON-NEWTONIAN AQUEOUS SOLUTIONS OF POLYETHYLENE OXIDE
W. R. Gambill 9 Dec. 1968 38 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2445) Avail: CFSTI

Critical heat flux tests were conducted at atmospheric pressure with subcooled aqueous solutions of 0.01, 0.25, and 0.50 wt% Polyox (polyethylene oxide water-soluble resin) heated by a horizontal, 0.234-in.-OD, resistively heated, A-nickel tube. The critical heat fluxes were much smaller than those characteristic of water-cooled systems, but the critical wall superheats were generally larger. Twelve critical-flux correlations which have been proposed for the saturated-pool case were compared with the data extrapolated to zero subcooling; none showed satisfactory agreement.
Author (NSA)

N69-31187# Oak Ridge National Lab., Tenn.
PREPARATION OF THIN FILMS OF VANADIUM, NIOBIUM, AND TANTALUM FOR NUCLEAR INVESTIGATIONS
V. N. Karev et al [1968] 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Fiz. (Moscow), v. 32, no. 2, [Feb. 1968] p 328–331
(ORNL-tr-2108) Avail: CFSTI

Equipment and procedures for preparing thin films of Nb, Ta, and V by thermal decomposition of VI_2, and the pentachlorides and pentaiodides of Nb and Ta on heated substrates are described. For V, a Be substrate was used, and for Nb and Ta, Mo substrates 0.1 mm thickness were used. Deposition of V was observed at ~1230°K which corresponded to the predicted temperature based on thermodynamic calculations but the films were nonuniform and separated from the substrate. Films of Nb and Ta were of uniform thickness and could be separated from the substrate by dissolution of the Mo substrate in dilute HNO_3.
NSA

N69-31210# Boeing Co., Renton, Wash. Commercial Airplane Div.
THERMAL ANALYZER (BETA II) PROGRAM PROCEDURES FOR HEAT TRANSFER ANALYSIS OF AIRCRAFT HYDRAULIC SYSTEMS
J. T. Cassan 11 Apr. 1969 58 p refs
(AD-686431; D6-58389) Avail: CFSTI CSCL 13/7

The procedure and examples contained herein are intended to facilitate a more rapid understanding and utilization of the Thermal Analyzer Program for heat transfer analysis of aircraft hydraulic systems. A simple hydraulic circuit was selected for illustration and explanation of the procedure involved in using the Thermal Analyzer Program. Simulated examples of actual aircraft hydraulic systems are included in the Appendix as additional references. These are far more complex in that they represent actual hydraulic systems used in current aircraft. Author (TAB)

N69-31239*# Stanford Univ., Calif. Thermosciences Div.
HEAT TRANSFER TO THE HIGHLY ACCELERATED TURBULENT BOUNDARY LAYER WITH AND WITHOUT MASS ADDITION
W. M. Kays, R. J. Moffat, and W. H. Thielbahr Feb. 1969 36 p refs
(Grant NGR-05-020-134)
(NASA-CR-103308; HMT-6) Avail: CFSTI CSCL 20M

Experimental heat transfer data are presented for a series of asymptotic accelerated turbulent boundary layers for the case of an impermeable wall, for several cases of blowing, and suction. The data are presented as Stanton number versus enthalpy thickness Reynolds number. Acceleration causes a depression in Stanton number when the wall is impermeable. Suction increases this effect, while blowing suppresses it. The combination of mild acceleration and strong blowing results in Stanton numbers which lie above the correlation for the same blowing but no acceleration. Velocity and temperature profiles are presented, from which it is possible to deduce explanations for the observed behavior of the Stanton number. A prediction scheme is proposed which is demonstrated to quite adequately reproduce the Stanton number results, using correlations derived from the profiles. Author

N69-31367# Aro, Inc., Arnold Air Force Station, Tenn.
THE SOLUTION OF COMBINED CONVECTION AND RADIATION HEAT TRANSFER FROM LONGITUDINAL FINS OF ARBITRARY CROSS SECTION Final Report, May–Nov. 1968
Percy B. Carter, Jr. AEDC Apr. 1969 99 p refs
(Contract F40600-69-C-0001)
(AD-686408; AEDC-TR-69-88) Avail: CFSTI CSCL 20/4

The effects of combined radiative and convective heat transfer from arrays of longitudinal fins of arbitrary profile are analyzed subject to non-uniform surface emissivity and non-uniform surface film coefficients. Consideration is given to radiative interactions between adjacent fins and between fins and the base surface. Solution of the defining differential equation for fin temperature distribution is obtained through an iterative application of the B. G. Galerkin variational technique. Application of the method of solution is made to fins of parabolic, triangular, and inverse parabolic profile subject solely to the radiative mode of heat transfer. Effects in variations of the dimensionless radiation number, fin spacing, and fin surface emissivity, are investigated. Findings of the study reveal that for the pure radiative mode, fins can enhance the heat transfer between the base and the surroundings only for the case of low fin and base surface emissivity. Author (TAB)

N69-31560# Institute of Nuclear Research, Warsaw (Poland).
ELECTRIC RESISTANCE ANALOGY FOR HEAT TRANSFER STUDIES. PART 2: THE ANALYSIS OF ACCURACY
A. Strupczewski 1968 65 p refs
(INR-949-PT-2) Avail: AEC Depository Libraries

Theoretical and experimental accuracy studies of the Resistance Analog Computer are described. Space and time truncation errors are discussed and the accuracies of RAC components measured and their influence upon overall solution accuracy computed. Several problems with known analytical solutions are solved and the predicted solution accuracy is compared with the value obtained experimentally. The comparison gives satisfactory results, providing soundness and usefulness of accuracy assessment methods discussed. Author (NSA)

N69-31567# Los Alamos Scientific Lab., N.Mex.
TESTS OF THERMODYNAMIC PREDICTION INVOLVING THE MEASUREMENT OF TIN-MERCURY SOLUTION ACTIVITIES BY DIFFERENT TECHNIQUES
Guy R. B. Elliott and Donald R. Conant 10 Dec. 1968 13 p refs
(Contract W-7405-eng-36)
(LA-4063) Avail: CFSTI

Published activity measurements on tin–mercury solutions are discussed along with other tests of thermodynamic theory, particularly the Duhem relationship. It is concluded that thermodynamic theory quite possibly is inexact when applied to real solutions. Author (NSA)

N69-31643# Oak Ridge National Lab., Tenn.
REDESIGN OF A HIGH-TEMPERATURE ENGINEERING SCALE FACILITY FOR DETERMINING STEAM-GRAPHITE REACTION RATES
R. E. Helms, F. H. Neill, D. M. Richardson, and E. R. Taylor May 1969 22 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2455) Avail: CFSTI

The ORNL engineering-scale facility for determining steam–graphite reaction rates was redesigned to permit exposure of large test specimens of graphite to flowing steam at high temperatures. The redesigned facility will permit exposure of a 2-in.-OD, 1/2-in.-ID, 26 1/4-in.-long graphite specimen to steam at temperatures up to 2732°F, pressures up to 150 psig, and steam flow rates up to 125 lb/hr. A sample and gas analysis system is provided to determine the total production of gaseous products; however, the changes produced in the graphite specimen will be further evaluated by physical inspection techniques following exposure to steam at the selected test temperatures. Author (NSA)

N69-31658# Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.
FILM CONDENSATION OF LIQUID METALS: PRECISION OF MEASUREMENT
Stanley J. Wilcox and Warren M. Rohsenow Apr. 1969 121 p refs
(Grant NSF GK-1113)
(DSR-71475-62) Avail: Issuing Activity

An error analysis indicates that the reported pressure dependence of the condensation coefficient at higher pressures is due to an inherent limitation in the precision of the condensing wall temperature measurement. The magnitude of this limitation in precision is different for the various test systems used. The analysis show, however, that the primary variable affecting the precision of the wall temperature measurement is the thermal conductivity of the condensing block. To verify the analysis, potassium was condensed on a vertical surface of a copper condensing block. The copper block was protected from the potassium with nickel plating. Condensation coefficients near unity were obtained out to higher pressures than those previously reported for potassium condensed with stainless steel or nickel condensing blocks. These experimental results agree with the prediction of the error analysis. Author

N69-31686# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
FORCED-CONVECTION, DISPERSED-FLOW FILM BOILING
S. J. Hynek, W. M. Rohsenow, and A. E. Bergles Apr. 1969 139 p refs
(Grant NSF GK-1759)
(DSR-70586-63) Avail: Issuing Activity

Heat transfer data are presented for vertical nitrogen upflow in an electrically heated tube 0.4 in i.d. and 8 ft long. Heat fluxes up to 18,000 Btu/ft^2-hr and mass fluxes up to 200,000 lb$_m$/ft^2-hr were investigated. Operation in two distinct film boiling regimes was possible by varying startup procedures. By preheating the tube, film boiling was observed throughout the test tube. If the flow was started before applying power, film boiling was initiated downstream of the inlet. Local heat transfer coefficients were different for similar conditions in the two cases due to the different degrees of thermal nonequilibrium. A nonequilibrium model predicted data well for both regimes. The model was also applied to methane, propane, and water data. The tests were repeated with tight-fitting, full-length twisted tapes installed in the test tube. Considerable augmentation of the heat transfer was achieved, with the heat transfer coefficient being increased by as much as a factor of 3 with the tightest tape twist. For the higher mass fluxes the tape promoted droplet deposition to such an extent that a continuous liquid film could be re-established on the wall near the test section exit. K.W.

N69-31713# Oak Ridge National Lab., Tenn.
AN EXPERIMENTAL STUDY OF THE CRITICAL HEAT FLUX FOR LOW PRESSURE BOILING WATER IN FORCED CONVECTION IN A VERTICAL SEVEN HEATER ROD BUNDLE
J. K. Jones Apr. 1969 123 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2122) Avail: CFSTI

The effects of inlet subcooling, pressure level, mass flow, and shroud heating on the flow boiling crisis with water at near-atmospheric pressure levels in upward flow through a seven-rod bundle were studied. Surface-to-surface rod spacing was restricted to 1/16 in. The boiling crisis was achieved by maintaining constant the boiler heat rate and the inlet fluid temperature while incrementally reducing the inlet mass flow. The onset of critical conditions was indicated by temperatures measured on the longitudinal axis near the outlet end of the heater rods and by leakage currents measured across the heater insulation between the heating element and the central thermocouple sheath. The first method was found to be more precise, and the results reported are for the incipient boiling crisis as manifested by a 50°F rise in the central temperature of the heater rod. The critical heat flux data agreed well with limited critical heat flux data obtained with potassium. Author (NSA)

N69-31726# IIT Research Inst., Chicago, Ill. Dept. of Physics.
THERMAL MEASUREMENTS ON SOLIDS BELOW 1°K Progress Report
Harold Weinstock Feb. 1969 12 p refs
(Contract AT(11-1)-1629)
(COO-1629-13; PR-3) Avail: CFSTI

Thermal conductivity studies of cobalt complexes with thiourea and of pure potassium chloride single crystals irradiated by gamma radiation are presented. Magnetic probes calibrated indium arsenide. Cobalt chloride with thiourea were measured in a magnetic field. J.A.M.

N69-31731# Argonne National Lab., Ill.
ENTROPY AND HEAT CAPACITY OF URANIUM BORIDES [ENTROPIYA I TEPLOEMKOST BORIDOV URANA]
L. G. Podobeda et al Mar. 1969 27 p refs Transl. into ENGLISH from IAEA Paper SM-98/51,[1968] p 745–765 Presented at the 3d Symp. on Thermodyn. of Nucl. Mater. with Emphasis on Soln. Systems, Vienna, 4-8 Sep. 1967
(ANL-Trans-729; CONF-670815-9)

The results of a theoretical determination of the standard values of the entropy and heat capacity and the temperature dependence of the heat capacity of uranium borides are reported. Use was made of new approaches, as well as of most of the currently known methods of calculating by empirical formulas and relationships. Comparison of the thermodynamic constants in series of diborides of the same type reveals a number of relationships between the heat capacity and the physical constants of the diborides. Author (NSA)

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N69-30614 Washington Univ., Seattle.
AN EXPERIENCE-GATHERING PROBLEM-SOLVING SYSTEM
John Ross Quinlan (Ph.D. Thesis) 1968 77 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-1206

A heuristic system is presented for solving a sequence of transformations that changes a starting object to a new object, where this latter object meets given specifications. One of its more powerful features is the ability to select transformations for trial using information that is algorithmically derivable from the definition of these transformations. Two implementations of this system that use collected experience in conjunction with general methods for categorizing transformations are defined, and their performance on more than seventy problems is detailed. Emphasis is placed on their improvement as problem-solving experience is gathered. The ability to transfer this experience from one task area to another is shown. The implementations are compared by fitting a simple model to each and comparing the models. The system and the implementations are evaluated in terms of their problem-solving scope and power. Dissert. Abstr.

N69-30678 Stanford Univ., Calif.
SURFACE ENERGY AND SURFACE TENSION AS BOUNDARY CONDITIONS ON HOLES AND CRACKS
Yapa Appuhamilage Don Stripala Rajapakse (Ph.D. Thesis) 1968 84 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-273

A theory of brittle fracture is presented in order to explain the difference between the theoretical estimates of strength of materials and their experimentally observed values. This discrepancy was attributed to the existence of minute flaws in real materials which act as stress concentrators. To obtain a criterion for the

spread of these flaws resulting in fracture, it was assumed that surfaces of solids possess surface tension, just as liquids do. Using a solution of Inglis for the stresses and strains in an infinite plate containing a free elliptic hole, loaded at infinity, the strain energy term was evaluated. The condition for crack extension was written in the form of a balance of release of potential energy of the system (consisting of the elastic strain energy of the plate and potential energy of applied tractions), and increase of surface energy as the crack extends. Dissert. Abstr.

N69-30748*# Drexel Inst. of Tech., Philadelphia, Pa. Center for the Study of Environment.
TECHNOLOGY AND MANAGEMENT OF LARGE-SCALE PROGRAMS Semiannual Progress Report
W. W. Hagerty, E. S. Golden, A. J. Pennington, and M. Silver 30 Jun. 1969
(Grant NGL-39-004-020)
(NASA-CR-103227; SAPR-1) Avail: CFSTI CSCL 05B

The developments to bridge the gap between advanced technology and management are reported with the educational and research programs needed to solve real problems. The program which is considered a balance of education and research includes sections on: (1) technology of urban development and improvement, (2) management science, (3) behavioral science, and (4) educational program. The educational program, which is separately described, reflects a balance among fundamental elements of an effective approach to large-scale socially oriented programs. F.O.S.

N69-30816*# Maryland Univ., College Park. Computer Science Center.
KEY WORD IN CONTEXT INDEX AND BIBLIOGRAPHY ON COMPUTER SYSTEMS SIMULATION AND EVALUATION
Sarah Crooke and Jack Minker 1 May 1969 42 p refs
(Grant NGR-21-002-197)
(NASA-CR-103212) Avail: CFSTI CSCL 05B

This document presents the output from a keyword in context (KWIC) index program. The output consists of two parts: a sort on keywords in the document titles, and a bibliography sequenced according to a code word assigned to each title. The bibliography includes title, author(s), and citation. The documents selected contain information pertinent to the areas of system evaluation, simulation languages, mathematical modeling, and simulation techniques applicable to time-sharing, multiprocessing, and multiprogramming systems. Author

N69-30831# Library of Congress, Washington, D.C. Aerospace Technology Div.
ELECTROMAGNETIC DISTURBANCES IN EXPLOSIONS [ELEKTROMAGNITNYE VOZMUSCHENIYA PRI VZRYVAKH]
L. M. Gorshunov et al 4 Apr. 1969 10 p refs Transl. into ENGLISH from Zh. Eksperim. Teor. Fiz. (Moscow), v. 53, no. 3, 1967 p 818–821
(AD-684893; ATD-68-88) Avail: CFSTI CSCL 19/4

Results of an investigation of electromagnetic disturbances produced by an explosion are presented. It is shown that the electromagnetic signal is determined mainly by the asymmetry of the scatter of the explosion products. Author (TAB)

N69-30923* Indiana Univ., Bloomington. Aerospace Research Applications Center.
KWIC INDEX OF INDUSTRIAL APPLICATIONS REPORTS, JANUARY–DECEMBER 1967
Donald R. Alsop 1 May 1969 218 p refs
(Contract NSR-15-003-076)
(NASA-CR-103217) Avail: CFSTI CSCL 05B

This index is part of an effort to accelerate the transfer of technology from the government sector to industrial applications. The KWIC (keyword-in-context) method is used in this volume to list alphabetically the keywords and the corresponding titles of a large number of available scientific and technical works with a high application potential for industry. The works cover a wide range of subjects in science and technology. K.W.

N69-30957*# Indiana Univ., Indianapolis. Aerospace Research Applications Center.
[AEROSPACE RESEARCH APPLICATIONS CENTER] Quarterly Report, 1968 and First Quarter 1969
Joseph Di Salvo 10 Jun. 1969 65 p refs
(Contract NSR-15-003-076)
(NASA-CR-103223) Avail: CFSTI CSCL 05B

Activities and operations of the Aerospace Research Applications Center are reported. The specific areas discussed include: (1) activity levels and mix of services, (2) promotional efforts, (3) expansion of the user base, (4) organization and manpower, (5) new products, and (6) training. F.O.S.

N69-31026*# Southeastern State Coll., Durant, Okla. Technology Use Studies Center.
TECHNOLOGY UTILIZATION IN A NON-URBAN REGION: A MEASUREMENT OF THE IMPACT OF THE TECHNOLOGY USE STUDIES CENTER Final Report
C. Henry Gold, Harold Warren, A. M. Moore, Don H. Carpenter, and Doyle L. Caton May 1969 152 p refs
(Grant NGR-37-004-008)
(NASA-CR-103218) Avail: CFSTI CSCL 05B

The role of technology in the economic development process is examined, and the objectives of the Technology Use Studies Center (TUSC) program of technology transfer are defined. An equation relating aggregate output to inputs is given, and graphs showing input factor (including technology) effect on the output growth are given. Tabulated data from the TUSC region include: manufacturing establishments by employment size, median family income by county, rank of TUSC counties by median family income, percent change in employment by county, components of employment change by industry, population by county, total employment, percent change in employment, new jobs and investment in new manufacturing establishments, and population trends. The data are analyzed and compared to the national average as a standard. Selected case studies indicative of impact are presented. F.O.S.

N69-31214# Joint Publications Research Service, Washington, D.C.
MYSTERIOUS MIGRATION OF BIRDS
V. R. Dolnik 2 Jul. 1969 90 p refs Transl. into ENGLISH of the book "Tainstvennyye Pereletsy" Moscow, 1968 p 1–112
(JPRS-48332) Avail: CFSTI

Bird migration was observed by radar and optical means. Banding of the birds to discover migration routes and habits is discussed. The instinct to migrate, the homing sense, and the metabolism are reported. Emphasis is placed on the relationship of the functions of internal secretion glands to the migratory urge. Charts on migratory paths and the percentage of lean to fat birds during migration are included. J.A.M.

N69-31231# RAND Corp., Santa Monica, Calif.
EVALUATION AS FEEDBACK IN THE PROGRAM DEVELOPMENT CYCLE

PUBLIC COLLECTIONS OF NASA DOCUMENTS

Majorie L. Rapp Apr. 1969 8 p
(AD-686412; P-4066) Avail: CFSTI CSCL 5/11

Evaluation used as a navigational aid can keep a program headed for its destination at the same time that it corrects for the necessary deviations from the projected course, not all of which could have been anticipated during the planning stages. By freeing us from over-commitment to our original idea which, after all, can be no more than an attempt to reach a destination by a specified route, process-oriented evaluation wisely used can ensure that we correct as we proceed and help us to arrive at our goals.
Author (TAB)

N69-31284# Office of Aerospace Research, Arlington, Va. Office of Scientific and Technical Information.
OVERCOMING BARRIERS IN R AND D COUPLING
Arthur A. Ezra (Denver Univ.) 14 Mar. 1969 15 p refs Presented at OAR Lectures on R and D Coupling and Information Transfer, 1969 Supported in part by ARPA and Army
(AD-686430; OAR-69-0005) Avail: CFSTI CSCL 5/1

The purpose of the paper is to share the lessons learned from a real-life effort of seeking practical applications of new technology resulting from research efforts under an ARPA contract. The paper identifies numerous obstacles that must be overcome by a proponent of a technological application; the manufacturing barriers of specifications costs, cost accounting systems and risks in innovation; the engineering barriers of configuration control, schedule and costs; the management barriers of risks and costs; development barriers of training and technology transfer, procurement and survival. The impact of these barriers is that the innovation process is a complex, multidisciplinary one, requiring many diverse skills - marketing, selling, finance, law and even psychology. Certain implications are pointed out for R and D management; the need for proper timing of the coupling process, the proper selection of the technology to be coupled, the need for the organization of the coupling programs, and a need for testing of some hypotheses.
Author (TAB)

N69-31291# Joint Publications Research Service, Washington, D.C.
ECONOMIC CYBERNETICS, ITS PROBLEMS AND FUTURE
N. Veduta 7 Jul. 1969 13 p refs Transl. into ENGLISH from Ekon. Nauki (Moscow), Apr. 1969 p 30–37
(JPRS-48358) Avail: CFSTI

The economic development of the socialistic society in Russia as compared with the economics of the United States is discussed. Emphasis is placed on automation and the expanded use of computers in industry production. The projected impact of cybernetics on the socialist society is assessed.
J.A.M.

N69-31333*# National Aeronautics and Space Administration. Goddard Spaceflight Center, Greenbelt, Md.
TEST PLAN OPTIMIZATION FOR AN EXPLORER-SIZE SPACECRAFT
J. H. Boeckel and A. R. Timmins Washington Jul. 1969 18 p refs
(NASA-TN-D-5283) Avail: CFSTI CSCL 22B

Although GSFC policy has required both a prototype (qualification model) and a flight (acceptance model) spacecraft, rising costs have caused a reexamination of this approach. In both the Interplanetary Monitoring Platform (IMP) and the Radio Astronomy Explorer (RAE) projects, a single spacecraft (termed proto-flight) was qualified and then successfully launched. The analysis discussed herein was conducted, using Monte Carlo techniques, to estimate whether this concept is truly cost-effective. The results of the study show a savings of approximately $1 million, using the proto-flight approach. It also shows that rigorous subsystem testing is effective in reducing costs if initial hardware quality is poor. The analysis assumes that each test approach treated produces equivalent spacecraft launch-readiness. Whether this assumption is true has not been determined; however, it could be expected to have some limitations.
Author

N69-31556# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.
APPROXIMATE JOINT PROBABILITY DISTRIBUTIONS OF THE TURBULENCE ALONG A HYPOTHETICAL MISSILE TRAJECTORY DOWNWIND OF A SINUSOIDAL MODEL RANGE
E. J. Plate, F. F. Yeh, and R. Kung Fort Monmouth, N.J. ECOM Feb. 1969 121 p refs
(Contract DAAB07-68-C-0423)
(AD-685833; CER68-69EJP-FY-RK-4; ECOM-0423-2) Avail: CFSTI CSCL 19/4

The wind field is investigated which is encountered by a missile traveling along a hypothetical trajectory downwind of a two-dimensional ridge. Reasons are given for studying this situation in a wind tunnel. The problem is reduced to the determination of turbulence spectra and of joint probabilities for the joint occurrence of two velocities simultaneously along the trajectory which corresponds to mean flow conditions. In the theoretical part an attempt is made to obtain approximations to the joint probability density distributions which yield to experimental evaluation. The experimental part is concerned with measurements of profiles of mean velocities and turbulent intensities and with the determination of turbulence data for evaluating spectra and joint probability distributions.
Author (TAB)

N69-31668# Cambridge Univ. (England). Cavendish Lab.
GROWTH OF BURNING TO DETONATION IN LIQUIDS AND SOLIDS Annual Summary Report, Nov. 1967–Dec. 1968
D. Tabor, J. E. Field, P. G. Fox, and M. M. Chaudhri Dec. 1968 24 p refs
(Grant AF-EOAR-0001-68)
(AD-686105; AFOSR-69-0997TR) Avail: CFSTI CSCL 19/4

The initiation and propagation of explosion in liquids and solids has been studied with special reference to the role played by discontinuities in promoting sensitivity, and the deflagration, detonation transition. In liquids the presence of cavities is important in both the initiation and transition to detonation stages of explosion. A detailed study has been made of the phenomena associated with a collapsing cavity such as jetting, heating of the gas in the cavity, and the production of an expansion shock during the rebound phase. The effect of collapsing a bubble by a weak shock (1 kbar) in the neighbourhood of single crystals of azides has been investigated. By careful choice of geometry it was possible to distinguish the relative importance of the various aspects of cavity collapse. In separate experiments it has been shown that thermal decomposition occurs when a fracture propagates through a crystal. The amounts and kinetics of the decomposition have been recorded for various crystal types, and temperatures associated with the fracture process evaluated.
Author (TAB)

N69-31883# Congress. House. Committee on Science and Astronautics.
APOLLO PROGRAM MANAGEMENT
James E. Wilson and Peter A. Gerardi Washington GPO Jul. 1969 267 p refs Staff Study for the Comm. on Sci. and Astronaut., 91st Congr., 1st Sess. Its Serial C
Avail: Subcomm. on NASA Oversight

The Committee on Science and Astronautics staff reviewed with the NASA and key contractors in the Apollo program their views of the management contributions of the Apollo program. Each participated in a recorded conference and summaries of the main

concepts are presented. These summaries represent a distillation of the accumulated management experience of each of the organizations and its application to the Apollo program. Since each industrial participant already had many years of corporate experience in major program management, both Federal and commercial, a major contribution from previous experience is a part of this record.
Author

N69-31761# Oak Ridge National Lab., Tenn.
COMPILATION OF UNITED STATES NUCLEAR STANDARDS
Apr. 1968 161 p refs 5th Edition, 1968
(Contract W-7405-eng-26)
(ORNL-NSIC-57) Avail: CFSTI

A complete list of codes and standards which are applicable to the nuclear industry is presented. The standards activities of all organizations, including technical societies and government agencies, are tabulated.
NSA

N69-31772# Congress. House. Committee on Science and Astronautics.
INTERNATIONAL BIOLOGICAL PROGRAM
Washington GPO 1969 196 p Hearings on H. J. Res. 589 Before Comm. on Sci. and Astronaut., 91st Congr., 1st Sess., no. 6, 6-7 May 1969
Avail: Subcomm. on Sci., Res., and Develop.

A transcript of the hearings held to discuss a resolution made by the subcommittee in support of the International Biological Program (IBP) is presented. The IBP is sponsored in the United States by the National Academy of Sciences and the National Academy of Engineering. The IBP is concerned with the immediate or near potential of mankind to damage, possibly beyond repair, the earth's ecological system on which all life depends. The statements in this volume are by the chairman of the U.S. National Committee for the IBP; the chairman of the Federal Intergovernmental Coordinating Committee on the IBP; the director of the Office of Science and Technology, Executive Office of the President; and the vice chairman of the Canadian Committee, IBP. Also presented are relevant communications, questions for a special study on the IBP, an analysis of needs and objectives of the IBP in the U.S., studies on ecosystems, and views on man's survival in a changing world.
K.W.

N69-31773# Congress. Senate. Committee on Aeronautical and Space Sciences.
NASA AUTHORIZATION FOR FISCAL YEAR 1970
Anderson Washington GPO 1969 110 p Rept. on Bill H.R. 11271, 91st Congr., 1st Sess. Calendar No. 273, 26 Jun. 1969 (Rept-91-282) Avail: US Capitol, Senate Document Room

This report containing congressional adjustments to the fiscal year 1970 request was attached to the NASA authorization bill (H.R. 11271). The report summarizes the purpose of the bill and its legislative history. Detailed discussions and data are presented on the research and development projects covered by the bill, on construction of facilities, research and program management, legislative changes, and space programs of government agencies other than NASA.
K.W

N69-31798# Congress. House. Committee on Appropriations.
INDEPENDENT OFFICES AND DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT APPROPRIATION BILL, 1970
Evins Washington GPO 1969 47 p Presented by the Comm. on Appropriations at the 91st Congr., 1st Sess., 19 Jun. 1969 (Rept-91-316) Avail: US Capitol, House Document Room

This report concerns budget amendments and was attached to the bill making appropriations for several independent executive bureaus, commissions, corporations, agencies, offices, and the Department of Housing and Urban Development for the fiscal year ending June 30, 1970 (H.R. 12307). The amendments apply to the budgets of the following: National Aeronautics and Space Council; Office of Emergency Preparedness; Office of Science and Technology; Appalachian regional development programs; disaster relief; Appalachian Regional Commission; Civil Service Commission; Federal Communications Commission; Federal Home Loan Bank Board; Federal Power Commission; Federal Trade Commission; General Services Administration; National Aeronautics and Space Administration; National Science Foundation; Renegotiation Board; Securities and Exchange Commission; Selective Service; Veterans Administration; and Civil Defense.
K.W

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